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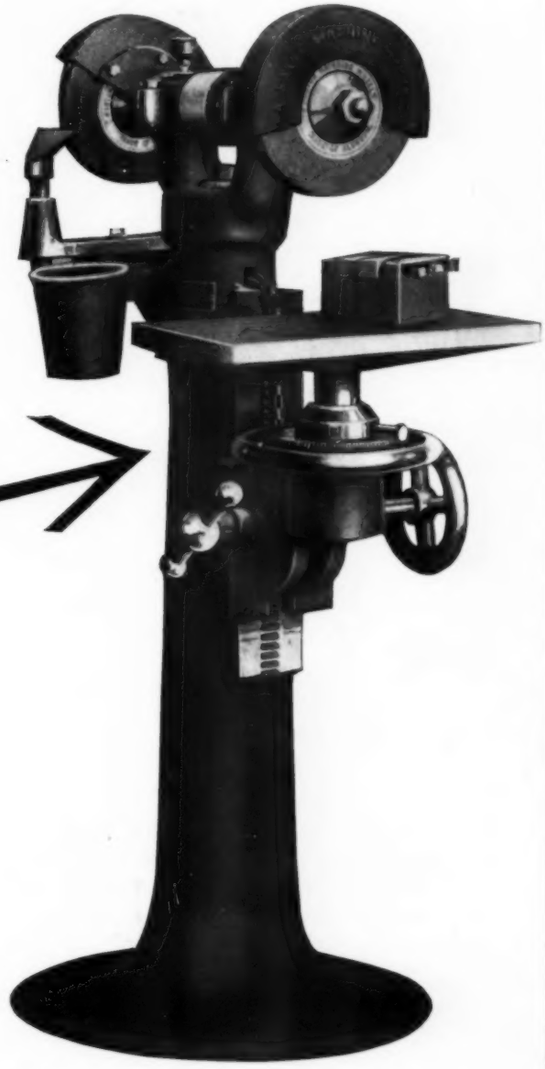

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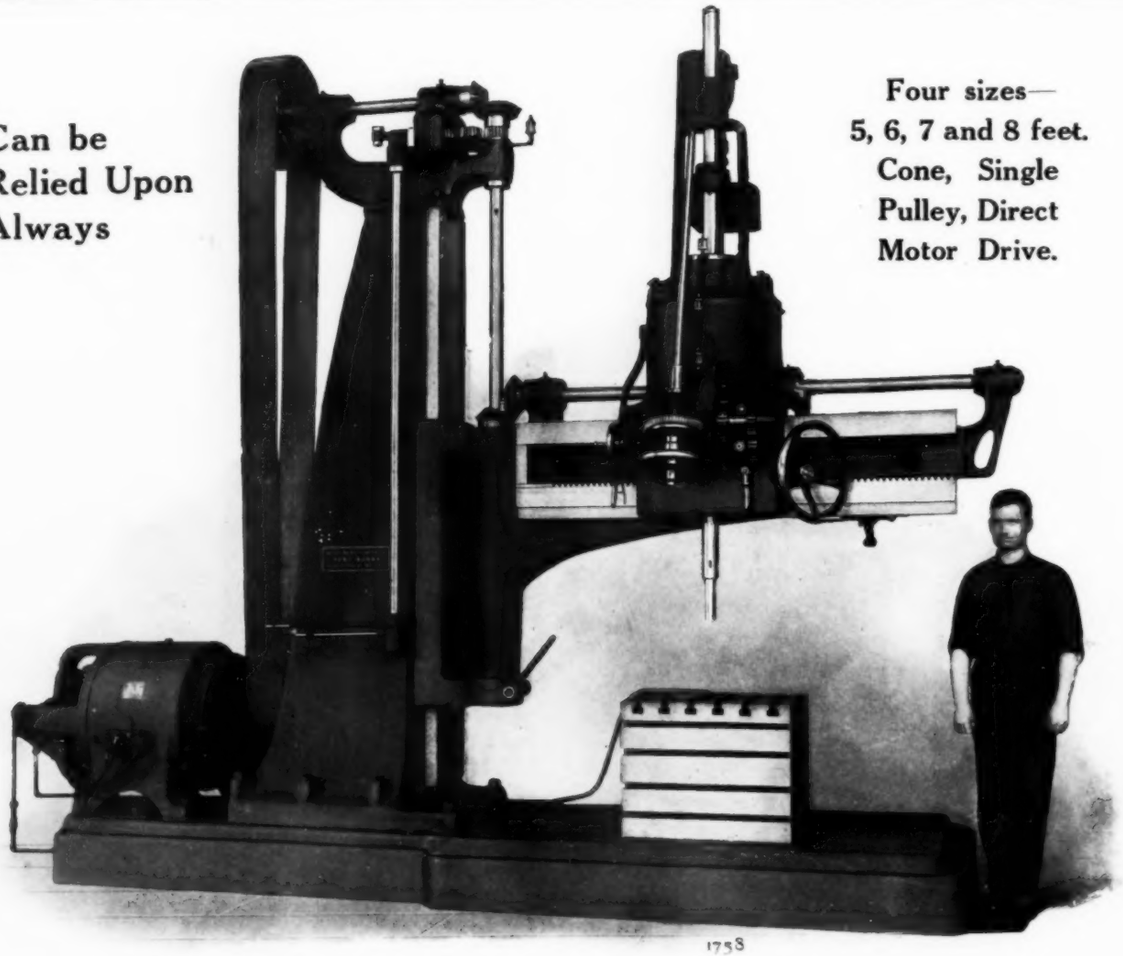

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(*See page* 48)

Building Small Induction Motors

By F. A. Stanley*

Laminations for stators notched in a special machine which indexes the work under the punch by means of a ratchet wheel controlled by feed and stop pawls that assure correct position for each notch.

Methods and tools for boring facing and grooving motor frames, with attachments for the vertical miller which bring important surfaces into cor rectrelation to one another.

*Western editor.

Of the numerous special machines employed at the plant of the Triumph Electric Company, at Oakley, Cincinnati, O., none is of greater interest than the two illustrated in Figs. 1, 2 and 3. The first of these, shown by Figs. 1 and 2, is a "painting" machine for coating laminations with insulating material; the second, Fig. 3, a machine for forming internal notches in stator laminations for induction motors.

The painting machine is adapted to handling all kinds of laminations, for various types of motors, and all sizes as well. While its operations are subsequent to the notching processes, it will for the purposes of this article, be described first, the remaining illustrations being devoted entirely to the methods of producing motors of the induction type.

Principal Features of the Painting Machine

The character of the painting machine will be gathered upon inspection of the first two engravings. It consists, primarily, of a set of feed rolls, a set of painting rolls, and a long, steel apron or conveyer, which receives the disks, or other laminations as they emerge from between the rolls, and carries them to the further end of the machine, giving ample time in the process of transfer, to permit the insulating material to dry.

The feeding table upon which the notched laminations are placed for slipping between the first set of rolls, is seen in Fig. 1, which also shows the conveyer apron extending a distance of nearly fifty feet before it passes over the driving and supporting sprockets at the far end of the steel framework. The laminations as they pass between the steel rolls are freed of all burs and fins due to the notching process, and upon sliding down the incline at the front of the feed rolls, as in Fig. 2, they pass between a pair of composition printing-press rollers which give both sides of the disks an even coat of the special material which is used to prevent flow of eddy currents from disk to disk after the armature core is assembled under great pressure. This insulating medium in its liquid form is contained in a tank under the rollers shown in Fig. 2, and is transferred to the painting rollers in much the same way that the ink in a printing press is distributed.

The Drive, Conveyer Apron, Etc.

The machine is operated by two motors, one for driving the feed rolls, the other for actuating the endless steel apron upon which the freshly coated disks are dried as they are carried along to the end of the apparatus. The motor for the apron drive is a variable-speed ma-

Fig. 1. Painting Machine for Coating Laminations with Insulating Material

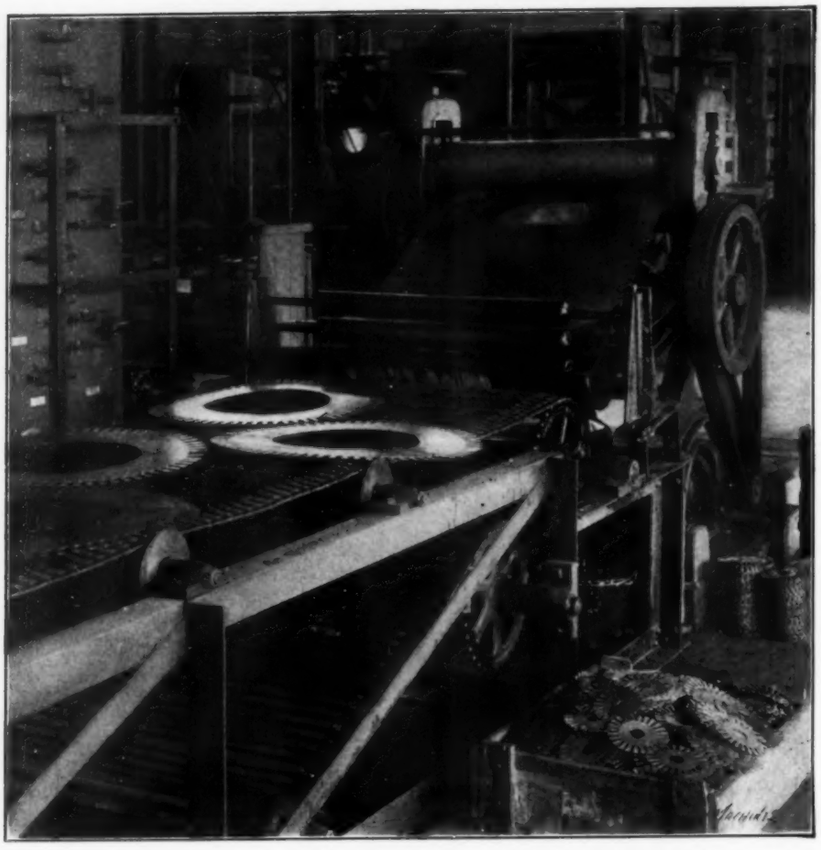


FIG. 2. FRONT VIEW OF PAINTING ROLLERS, CONVEYING APRON, ETC.

chine to permit the carrier to be operated at different speeds in accordance with weather conditions, the work drying more rapidly under some conditions than under others, and at such times requiring proportionately less time in its passage out of the machine.

The motor for the carrier or apron drive, is placed overhead, and the belt leading down to the worm-driving gear at the side of the machine will be noticed at the extreme left side of the view in Fig. 1. The worm gearing actuates a shaft with a pair of sprockets which work in conjunction with the two sprocket chains forming the sides of the apron. Between the ends of the machine a series of grooved idler pulleys support the chains, and these are plainly shown on the upper and lower longitudinal members of the framework. The endless belt or apron, is made up of a large number of light-steel angle strips placed crosswise between the chains and forming a strong, though flexible carrier.

THE NOTCHING MACHINE

The notching machine, Fig. 3, like the painting machine was designed and built in the Triumph shops. It is used for stamping the notches in stator laminations for induction motors and is adapted for notching a range of sizes running from laminations with a central hole of 7¾ inches diameter to those with a 24-inch opening. It is equipped with index rings which provide for the punching of from 36 to 200 notches around the inside of the work and these rings are in the form of ratchet wheels, six or seven of which are sufficient to cover the entire range of laminations which it is desired to notch. In all cases two laminations are placed in the machine, one upon the other, and notched simultaneously.

The machine is motor driven and power is transmitted to the operating mechanism inside the column through the medium of a friction. The foot treadle that controls the movement of the ram and punch, has three functions which it performs each time it is depressed; that is, when forced downward by the foot, it opens a brake on the driving shaft, withdraws the roll from the clutch-controlling cam to allow the positive clutch to go into engagement, and forces the driving friction into operation. Upon the foot being lifted from the treadle, the positive drive to the crank shaft is disconnected and the brake applied, stopping the ram at its uppermost point, at the same time the friction drive is released.

HOW THE WORK IS INDEXED UNDER THE PUNCH

The slotted crank disk at the side of the column of the machine is rotated by the main shaft and in turn imparts an oscillatory movement to the vertical shaft at the rear. To permit the connecting rod to work smoothly while attached to two members operating in planes at right angles to each other, the rod is provided with ball and socket bearings that allow it to roll about its own axis at the same time that it is reciprocating with the revolutions of the crank pin in the slotted disk.

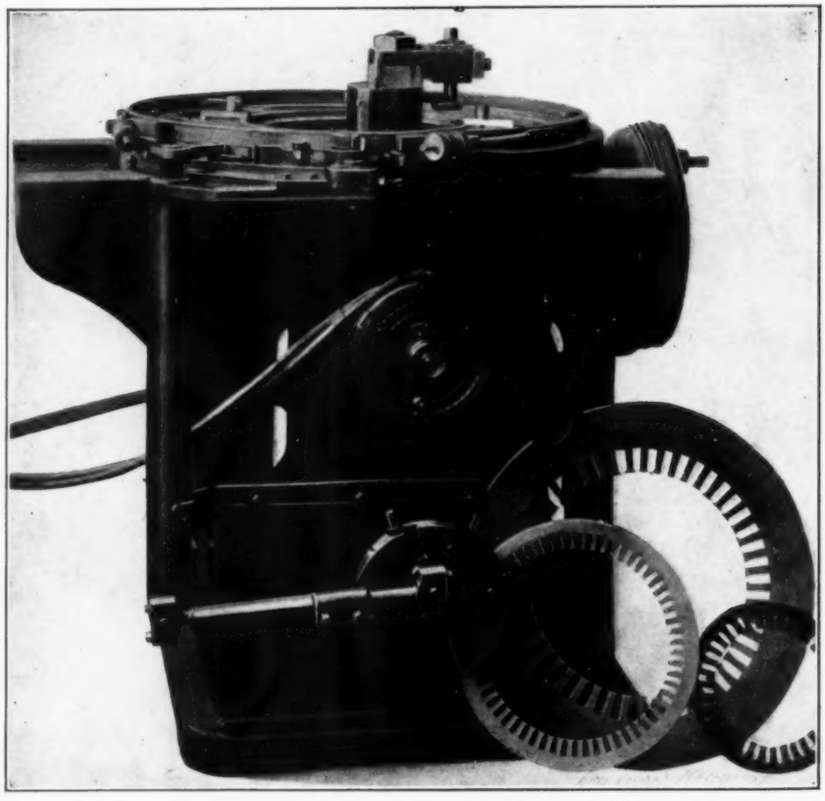


FIG. 3. NOTCHING MACHINE

The upper end of the vertical rock shaft actuates a pawl for advancing the work step by step with the ratchet ring in which it is secured. As the whole top of the machine, including the work holder, ratchet ring, pawl slide, etc., are carried upon an adjustable table that is moved forward or back to suit the size of lamination to be punched, the vertical rock shaft must also be movable bodily to conform to the setting of the work table, and this is permitted by the telescopic connecting rod at the bottom and the slotted brace which is adjusted along the column to suit the position of the long sleeve in which the vertical shaft is journaled.

The Pawl Slide and Ratchet Stop

The sketch, Fig. 4, is merely to indicate the method of actuating the ratchet ring and stopping it in correct position for each notching stroke of the punch. Here the top of the vertical rock shaft is shown at *A* with a rocker arm and link connecting with slide *B* upon which is pivoted pawl *C* for actuating ratchet ring *D*. The latter is attached to and operates a disk in which the work-holding ring is placed, this being changed for each size of lamination. At *E* is a pawl upon a stationary pivot and at *F* a leather band attached by spring connections to two fixed brackets *G G* and passing around a grooved flange above the ratchet ring *D*.

The slide *B* is shown in its extreme forward position at the completion of its advancing action upon the ratchet ring *D*. In this position it will be noticed that the tooth opposite fixed pawl *E* is slightly ahead of the point of the pawl. It will also be seen that leather band *F* has drawn compression spring *H* up tightly, and allowed spring *I* at the opposite end to expand. Now, when pawl slide *B* is moved to the right in preparation for its next forward stroke, the compressed spring *H* will pull band *F* back against the weaker pull of open spring *I* and the band in turn will draw the ratchet back snug against fixed pawl *E*. When pawl slide *B* again starts forward the band *F* "loads" spring *H*, allows spring *I* to open to keep the band taut, and when the mechanism has reached the position illustrated, the cycle described is repeated.

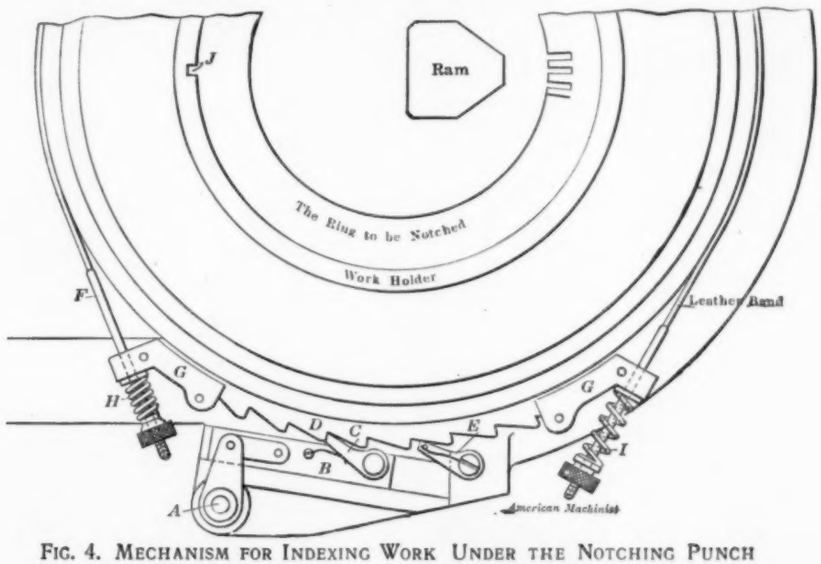


FIG. 4. MECHANISM FOR INDEXING WORK UNDER THE NOTCHING PUNCH

Rapid Action and Accuracy Secured

The machine runs at a very rapid rate and at each stroke the ratchet index ring is brought back snugly against the stop pawl *E* which assures a positive indexing position with no possibility of the work jumping ahead, and with each notch punched in the correct location, assuming, as is the case, that the index ring is itself correctly cut.

In blanking out the ring laminations prior to punching the notches a small projection is left at one side, as shown at *J*, Fig. 4, and this is used in locating the lamination in its receiver on the notching machine, and later in assembling, the same lug locates the notched lamination in the motor frame, by a keyway which assures the notches in all of the laminations coming in exact register with each other.

After the laminations leave the notching machine they are cleansed of grease and dirt by immersion in a potash tank and then plunged and washed thoroughly in clear, boiling water.

Machining Motor Frames

The motor frames are first gripped in the four chuck jaws on the table of the vertical boring mill and one side faced off as in Fig. 5. At the same setting a seat or recess is turned out in the face to receive what is known as a "roughing master plate," this seat being made the same diameter as the frame requires to be bored for the reception of the stator laminations. Then the frame is turned over and placed on the roughing master plate and bored out for the laminations.

In Fig. 6 this roughing master plate is shown on the table of the mill, and as there represented, it is a circular casting with a locating boss by which it is centered upon the large flat disk that is attached to the faceplate of the machine. The upper face of the master plate is formed with a shoulder which receives and centers the motor frame as stated above. It is bolted to the round plate on the table, and the work itself is strapped in place, while the interior is bored for the laminations, the boring operation being followed by the cutting of a straight slot or keyway for the registering ears on the laminations, and by an annular grooving operation which forms a series of retaining pockets for the clamps which bind the laminations fast in the frame.

Cutting a Keyway in the Boring Mill

The operation represented in Fig. 6, is the cutting of the keyway for the registering lugs of the laminations. This groove is seen at *K*, Fig. 7, which shows in a general way, the form of the motor frame, with the interior bored to size, and the annular channel cut at *L* for the small clamps that hold the laminations in the frame. The cutting of keyway *K*, like the boring of the interior, is performed with the motor frame strapped down; but in the photograph, Fig. 6, which shows the master plate for both operations, the straps are not included as they were removed just before the exposure was made.

The keyway is cut with the saddle clamped to the cross-rail and a large handwheel slipped onto the end of the vertical feed rod. This supplies sufficient leverage to permit the operator to utilize the ram as a vertical slotter, and as the tool is carried in a short, stiff bar,

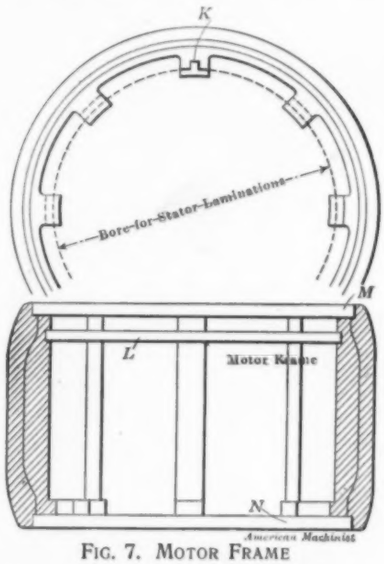


FIG. 7. MOTOR FRAME

it requires only a few passes to complete the keyway. The handwheel is then slipped off the squared end of the fuel rod and the turret indexed for boring the next frame for the reception of its laminations.

Finishing the Frame Interior

After the notched laminations have been assembled in the frame, as shown at *A* in Fig. 8, the whole outfit is placed on the expanding shell on fixture *B*, shown to the left in the same illustration. This forms an expansion arbor used on the boring-mill table for carrying the work dead true with the interior of the laminations. This is highly important as the air gap between the stator and rotor is very small and, consequently, the finishing of the seats for the end brackets which carry the rotor shaft must be accomplished in such a manner as to insure these seats coming exactly parallel with each other and concentric with the interior of the laminations; otherwise there will be either positive interference between stator and rotor, or an undesirable irregularity of action.

The expanding arbor, located centrally upon the boring-mill table, assures the frame mounted thereon rotating true with the bore of the laminations. While mounted in this manner the seat or counterbore at one end for one of the brackets, is finished out, as at *M*, Fig. 7. When the lot of frames has passed through this operation, the expanding fixture is removed and a finishing master plate located upon the vertical mill. This plate is seen at *C* in the center of the group in Fig. 8 and is of the same type as the roughing master plate referred to.

With the motor frame carried on this finishing plate by the finished seat machined in the preceding operation, the opposite seat for the bracket at the other end is turned out as at *N*, Fig. 7, with the assurance that it will be parallel to the first seat and that both will be concentric with the interior of the stator laminations. The sequence of operations is such that the surface just described as finished last, is the same one that was roughed out at the outset in the chuck jaws, to allow the frame to be mounted on the roughing master plate.

Splining Rotor Shafts

The rotor shafts of these induction motors, are provided with a spiral locating key for the laminations, so that when assembled on the shaft, the notches in the disks form a spiral slot which gives a shearing movement past the stator gap when the motor is running. The spiral cut for the key is made with the aid of the fixture in Figs. 9 and 10.

The spindle of this milling fixture has a 2¼-inch hole the full length, to admit shafts up to that size, and the rotary motion of the spindle during its advance is derived through the spirally grooved drum which is mounted upon it. The drum is controlled by the hardened roll on the arm at the rear of the table, shown in Fig. 10, and the series of grooves in the drum gives various leads from 120 to 145 inches per revolution of spindle.

The cutter is carried on an arbor in the vertical spindle attachment, and the latter is swiveled to bring the cutter faces into coincidence with the helix angle. The shaft represented in place in the fixture is a small size, but the appliance is used for shafts up to 7 feet in length, one end projecting through the hollow spindle, the other resting in a V-block.

Operations on Brackets

Reference has been made to the limited amount of clearance between stator and rotor in this type of motor; that is,

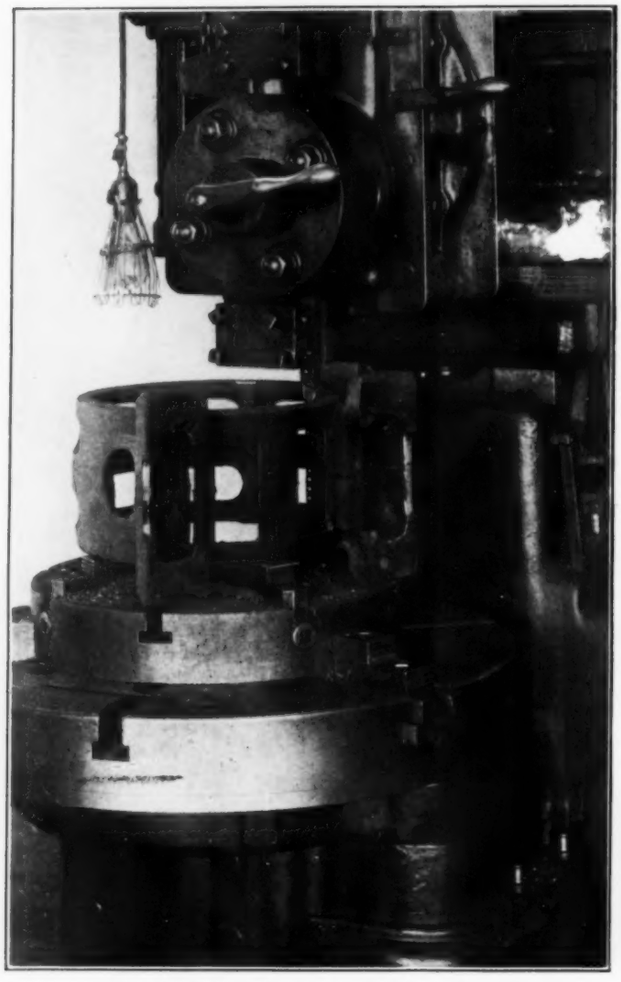


Fig. 5. Boring and Facing Motor Frame

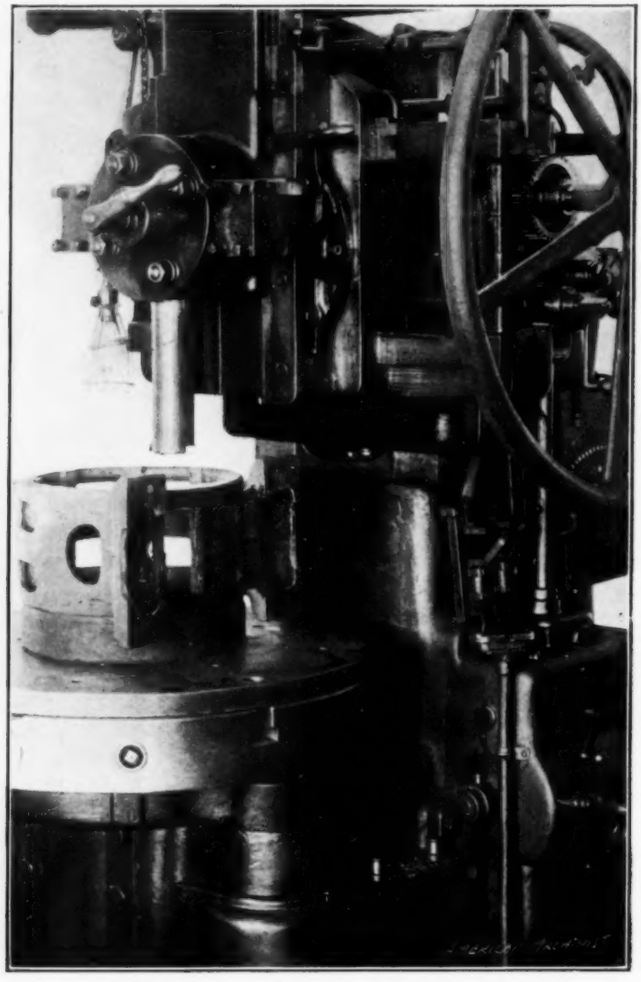


Fig. 6. Cutting Keyway in Motor Frame

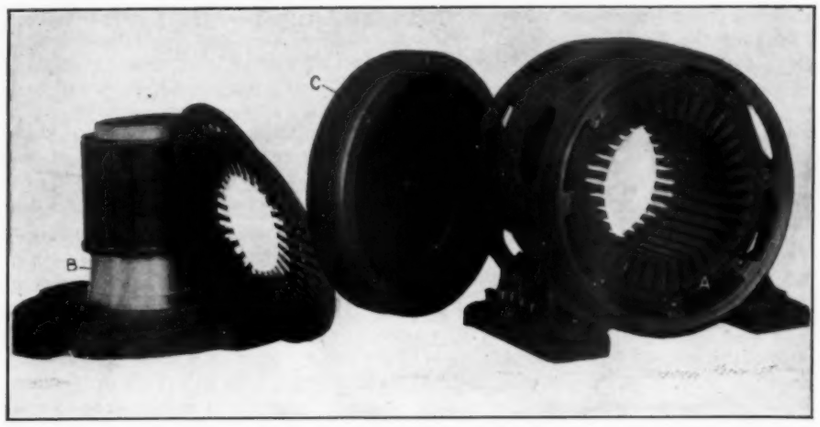


FIG. 8. EXPANDING FIXTURE AND FINISHING PLATE FOR MOTOR FRAME WITH LAMINATIONS IN PLACE

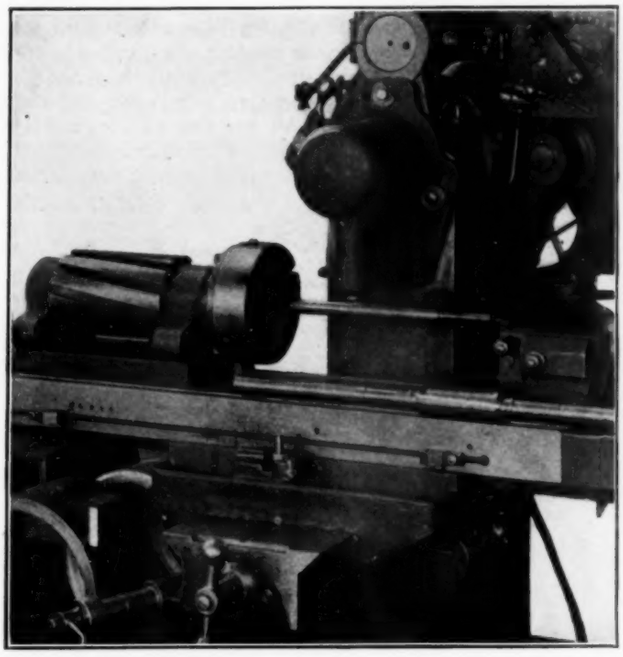


FIG. 9

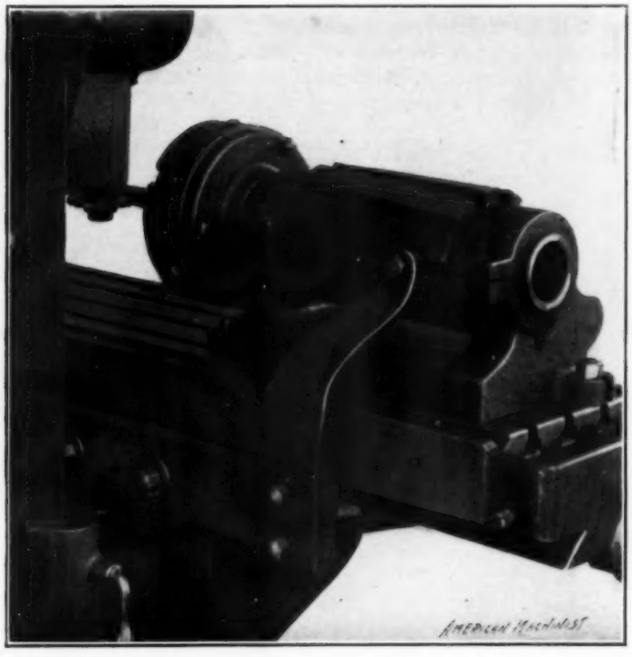


FIG. 10

SPIRAL MILLING ATTACHMENT

on motors of the size illustrated in this article, the air gap on each side is only 0.015 inch and only 0.002 inch variation from this figure is allowed. This means that the machine work on the rotor parts and on the shaft brackets has to be as accurate as on the frame itself, or when assembled the motor will not pass inspection.

The rotor laminations after the assembling upon their shaft, are ground accurately to diameter, and as the shaft is also ground, there is little difficulty in securing the necessary quality of work on this unit. The cast brackets, however, are a more difficult proposition. These are of the form shown at *D* the left-hand side of the group in Fig. 11, and require turning and facing (without springing) to fit accurately in the seats turned out in the ends of the motor frame. The bore of the hub should also be true with the rim and after the boring, turning and facing of the bracket have been accomplished, the casting is jig-drilled for the holes through the rim, oil holes, etc., and the brass box for the shaft is then inserted in the hub. The boxes are left a thousandth or two small in the bore and after the two brackets are bolted to the frame an alining reamer is passed through them, just scraping off the surface of the metal and assuring a proper fit for the rotor shaft.

INSPECTION OF MOTORS

When all parts are assembled, wound and ready for the running tests, the motor is inspected prior to starting it, to determine if the requirements as to air-gap width, and concentricity of rotor and stator have been fufilled. One bracket *D*, is removed, the rotor taken out, and a test arbor *E* slipped into place as in Fig. 11. The test arbor is the same diameter as the rotor and when the bracket is replaced, the arbor occupies the same position as the rotor will assume when put back. The set of feeler gages *F*, shown at the side of the motor,

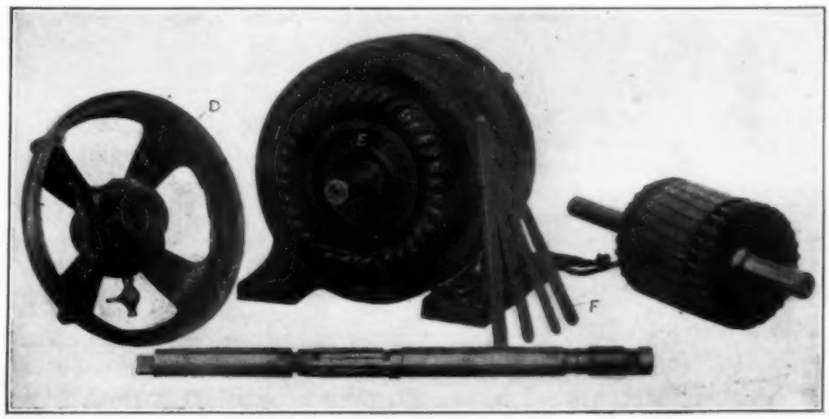


FIG. 11. TESTING ARBOR AND FEELER GAGES FOR MOTOR INSPECTION

are applied between the test arbor and the stator, at various points about the circle, so that if there should happen to be any departure from the specified limits the discrepancy would be readily discovered.

The alining reamer referred to above will, in Fig. 11, be seen in front of the bracket and motor frame. The rotor is plainly shown at the right of the frame. The feelers are long enough to enable them to be passed clear to the far end of the air gap, if desired.

Area and Volume of Irregular Shapes

By Alfred Englert

Suppose the area of an irregular surface is to be found. Fig. 1 shows such a surface; in this instance the radial section of a car wheel. If a planimeter is not available, a good method is as follows:

Secure over the figure a piece of transparent section paper. A standard section paper divided into ¼-inch squares and these again into 25 small squares, is recommended. Count the larger squares wholly within the surface, marking them with consecutive numbers. For the remainder of the surface, consider each 25 small squares as one large square. Where the boundary line of the figure cuts the small squares it will be necessary, for greater accuracy, to consider two or more of these partial small squares as one whole small square. To avoid confusion, it will be found essential to dot each small square when counted.

Area Scale

In Fig. 1, there are thirty two ¼-inch squares and 21 smaller squares, making 32 21/25, or 32.84 quarter-inch squares. Since in this case the figure is drawn ¼ actual size, each quarter-inch square represents one square inch, and the figure contains 32.84 square inches. If the scale of the figure shown were ½ size, 4 small squares would represent one square inch, and the figure would contain 32.84 divided by 4, or 8.21 square inches. If the scale of the figure shown were full size, 16 small squares would represent one square inch, and the figure would contain 32.84 divided by 16, or 2.0525 square inches; and so on for other scales. This matter of scale is very important and sometimes confusing. Remember that if linear dimensions are, say half size, areas will be quarter size; if linear dimensions are quarter size, areas will be one sixteenth size.

Center of Gravity of Section

The center of gravity of the surface may be found as follows:

Trace the figure upon heavy paper or card-board and cut it out. Suspend the figure thus made from a pin placed near the edge of the figure at *A*, Fig. 2, allowing it to hang freely in a vertical plane. Suspended a plumb line from the pin and draw upon the figure a line coincident with the position of this plumb line. Suspend the figure from another point *B* and find a similar line. Where the two lines intersect is the center of gravity of the surface.

Cubic Contents of the Casting

If, as in Fig. 1, the surface is a radial section of a surface of revolution of axis *XX*, the radius of the path of the center

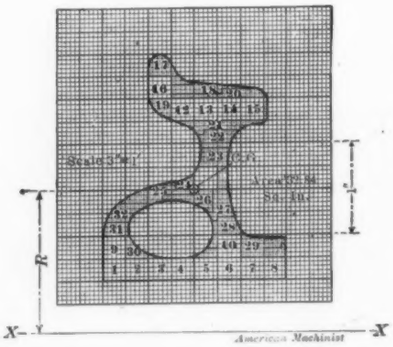


Fig. 1. Estimating the Area of an Irregular Figure

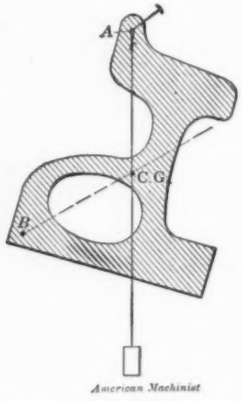


Fig. 2. Estimating Center of Gravity of an Irregular Figure

of gravity being *R*, the contents of the solid thus formed will be the area of the surface multiplied by the path of the center of gravity, or:

$$Contents = area \times 2\pi R.$$

In the case of the car wheel shown, $R = 7\frac{1}{4}$ inches, so

$$Contents = 32.84 \times 2\pi \times 7.25,$$

or 1500 cubic inches.

Weight of the Casting

To find the weight of the solid of revolution, multiply the contents by the weight per cubic inch of material. The car wheel being of cast iron weighing 0.262 pound per cubic inch, its weight is 1500 × 0.262 or 393 pounds.

Testing Forging Dies for Hardness

By A. Mertes

We have tried out many different kinds of steel for our forging dies and find that dies made from alloy steels will do 60 per cent. more work than those made from carbon steels, provided they are properly heat-treated.

At one time we made several sets of dies for the same class of work and from the same grade of air-hardening steel. They were heated in a clean fire, using a Morse thermo gage to get the proper temperature, and placed on the floor to cool.

When they were put in service, two sets broke in the first half hour, the third set made 20,000 forgings and were taken out owing to their being too soft, and a fourth set made 150,000. All were run on the same forging machine and handled by the same operator.

For hardness we tried the different sets with a file and found they could all be readily filed. We then tried a ¼-inch twist drill and found that it would just touch or cut the broken pieces of the first two sets before the cutting edge failed.

The third set was tried, after grinding the drill, and we found that it would enter the die ¼ of an inch before the edge failed.

The fourth set or the one that made the phenominal run could only be drilled 1/32 of an inch.

On going over our stock of partly worn out dies, we noted that nearly every set that had a record of 100,000 forgings could be drilled just about the same depth; namely, 1/32 of an inch. We then decided to conduct a number of experiments to see if we could depend on this drill test.

A bar of air-hardening steel 2 inches square was taken, as it came from the steelmaker, and planed on four sides. Then two blocks, 2 inches long, were sawed from the bar and hardened. The furnace was brought up to 1600 degrees Fahrenheit. A pyrometer with the fire end in the furnace was used during the test, also the lamp of a Morse thermo gage to watch the heat on the blocks.

One block was hardened at 1450 degrees Fahrenheit and one at 1600 degrees. On the block hardened at 1450 degrees the drill entered ⅜ of an inch before it stopped cutting. After several attempts on the block hardened at 1600 degrees we could not make the drill penetrate 1/64 of an inch.

When the same blocks were hardened at 1550 and 1575 degrees respectively, the drill entered the block hardened at 1550 degrees Fahrenheit 5/64 of an inch, while it entered the one hardened at 1575 degrees, 1/32 of an inch or the same depth that could be drilled in those of our old dies that gave good results.

While two blocks could be given the same amount of hardness by using pyrometers, gages, and a great deal of care, we could not harden dies day after day with the assurance that they would all be as near alike as was required. By testing each set of dies with the drill, as they came from the hardening room, we are able to return all dies that are too soft or too hard and have the satisfaction of knowing that all those that are accepted will give good results when placed in service.

A Cam Miller

By E. A. Dixie

The halftones show a slotting machine which, many years ago was converted into a cam miller by Ottmar Mergenthaler, the father of the linotype machine, and has been almost constantly at work ever since.

Mounted on the end of the counterbalanced ram is a train of gears to reduce the speed of the spindle when large cutters are used. Hinged to the end of the ram is a swinging casting *B* carrying the cutter spindle and provided with a long lever *E*, to the end of which is attached a rope running over a pulley at the back and supporting a weight to hold the follower roller in contact with the former. *G* is the cutter having a threaded hole which fits the end of the spindle. *F* is a roller a running fit on the plain part of the cutter. The roller *F* bears on the former *H*.

For very steep cams the long and cross feed is sometimes used, but for all ordinary cams the power feed to the rotary table is sufficient.

At *K* are shown two of the many varieties of cams cut on this machine. The cam is first mounted on the table with the former on top, as shown in the halftones. A roughing cut is first run around the inside. For this a suitable cutter and roller are chosen and screwed in place on the spindle. For large cutters the universal shaft *A* drives through the speed-reducing gears, as shown in the cuts, but when small cutters are used the shaft *A* is connected direct to the spindle at *C*. The ram is then lowered by means of the screw *I* to the correct depth, the spindle started and the lever *E* pulled into the cut and the weight attached to *E*. The circular feed is then started and the roughing cut run all the way around. The roller *F* is then replaced by one large enough to throw the cutter over to the other side of the cam path; the table travel is reversed, so that the cutter will run against the cut and the outer part of the path is roughed.

The finishing cutter is then inserted with a roller which will give the proper depth of cut for the inner side of the cam path.

If the cutter is run in the full depth of the finishing cut at once a groove is liable to be formed. A rather neat gradual feed for depth is used. A piece of paper about 6 inches long is folded four or five times and torn off in steps, as shown at *D*. The thick end is composed of, say, five layers of paper 0.003 inch thick, while the other end is only one thickness. The thick end is placed between the former and the roller with the thin end in the direction of the cut. The machine is then started up and the cutter drops gradually by steps 0.003 inch high into the cut, after which it travels around with the roller in contact with the former.

For finishing the outer side of the cam path a larger roller is again substituted and besides this a flexible ribbon of phosphor bronze, shown at *J*, Fig. 2, is placed between the former and the roller. These ribbons of phosphor bronze are from 0.005 to 0.030 inch thick, so that practically any depth of finishing cut is available without changing rollers again.

The machine will handle cams up to about 4 feet diameter. The cam being cut, shown in the illustrations, has a little over 3 feet of path and the operator can cut from three to four of these in 10 hours.

The machine is now in the works of Wm. Hollingsworth, 227 North Holliday street, Baltimore, Md.

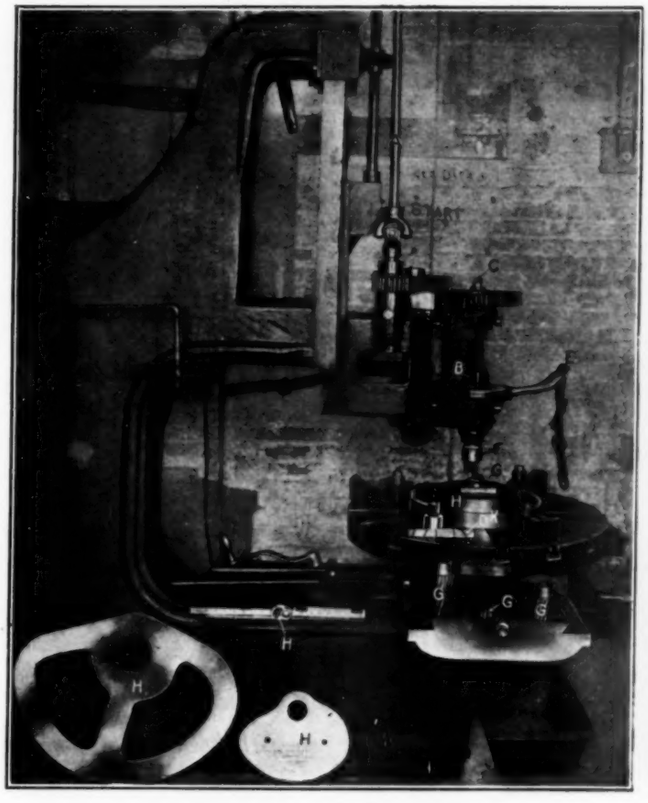


Fig. 1. The Machine with the Cutter Withdrawn from the Work

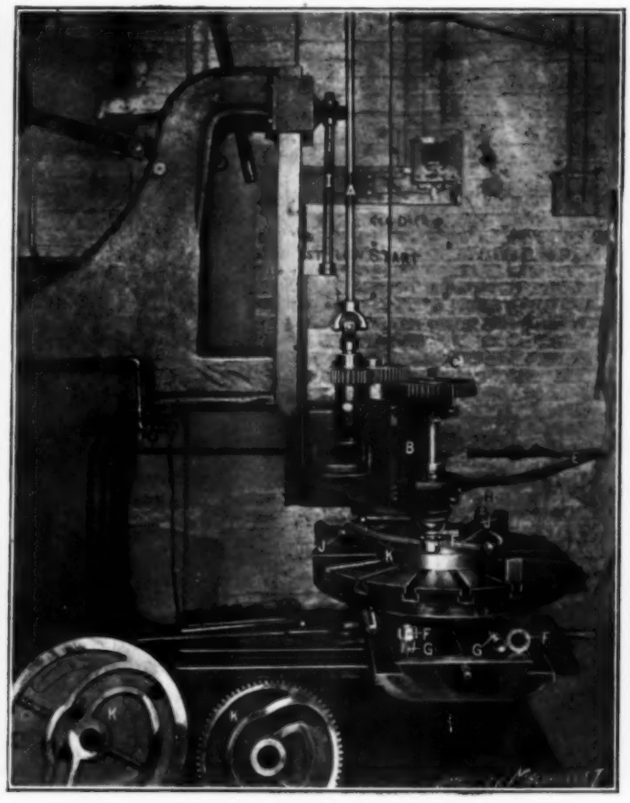


Fig. 2. The Machine with the Cutter In the Work

Making a Worm Gear Pattern

By A. Alertes

Having to make a worm pattern 9 inches diameter, 2 inches pitch, 16 inches lead, 8 thread, length of thread 6¾ inches, the methods that suggested themselves were: to chase it, to plane it, to mill it, or to cut it out by hand. To chase it was out of the question with the lathes at hand, to plane it required a great deal of rigging, to mill it would be all right, but I had no miller; to cut it out by hand was very tedious and it was doubtful if it would be true enough to unscrew out of the sand. I finally devised the following:

First, I made a pattern *A* about 12 inches diameter and 10 inches long, cored out to leave ½ inch metal. This I laid out on opposite sides to conform the helix or lead in 8 inches, as this was all that I needed as far as length was concerned. The helix was formed on the core. After the casting was made, it was turned, bored, faced and its periphery spaced with dividers for every ¼ inch of its lead, making 32 spaces in one-half revolution on opposite sides.

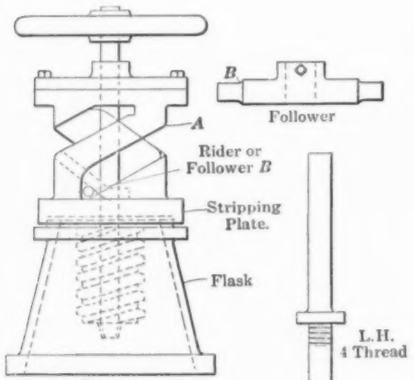


Fig. 1

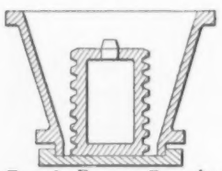


Fig. 2. Pattern Complete.

Then by inserting the spindle, and what I would term the follower (which was simply a casting shown at *B*), and fastening follower to spindle, it was readily tested for accuracy by turning the spindle until it coincided with one of the 32 vertical spaces, and measured for hight. The lowest spot was found first and the rest was filed to suit, on the working side only.

After having finished this, I made a pattern about 10 inches diameter and 7½ inches long, rammed it up in center of taper flask, withdrew the pattern and placed the above arrangement on top, as shown, Fig. 1, with the difference that in place of the finished worm pattern, it should show the mold ready to have the plaster poured in from the top and the spindle about 14 inches longer. The spindle had a ½-inch hole drilled through it about 10 inches from end and an oak pin driven through about 4 inches long. This was for the purpose of driving the plaster cast when cutting the threads. At this time I had a pail full of plaster of paris mixed and poured into the mold with the spindle in it. In about 10 minutes I uncovered the mold, or rather pulled the plaster cast and spindle out.

I then secured a large block and sawed it out to a one-half circle and fastened it to the bottom of Fig. 3. A handwheel, 18 inches diameter, set-screwed to outer end of spindle, was divided into eight parts with dividers as accurately as possible. The spindle with the plaster cast was now put in this rig and turned to diameter, leaving it 1/32 inch larger, after which it is put back into the position shown in Fig. 3, ready for chasing the threads, which was done as follows:

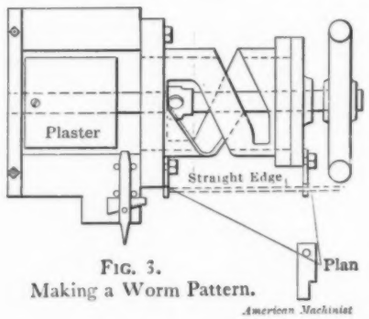


Fig. 3.
Making a Worm Pattern.
American Machinist

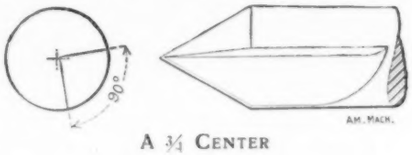
The whole arrangement was securely fastened on two horses and these to the floor. Then the spindle with the cast on it was pushed back into the "guide" (as I will hereafter call the helix arrangement) and an old file ground to the proper shape for the space of the worm, was located at the end of the cast, in fact, so located that there was ¼ inch between it and end of cast. The file or tool was let into the block its full thickness, which was about ⅜ inch, and four nails driven in, as shown in Fig. 3, and the file or tool fitted between. This file was ground parallel on its edges and had a hole drilled through it and a pin driven in as shown, for the purpose of feeding it to the cut by means of a wedge which was moved horizontally. Divisions was marked on the wedge, as when one pass was made the tool was withdrawn, and the wedge was moved to the next graduation, the pin abutting against the wedge limited the cut of the tool. Now, we are ready to chase. The tool is brought up to take a cut, the position of feed wedge is adjusted and the hand wheel is turned one-half revolution. The follower now rides in the guide, the tool is withdrawn, the wedge moved and a pressure exerted against the wheel, while turning it, to keep the rider or follower against the guide or helix. This operation is repeated until the tooth is fairly deep, leaving a little for a final finish.

When I started the first tooth I fastened the follower to the spindle, when the end of straightedge coincided with one of the divisions on hand wheel, and after roughing the first tooth the spindle is placed in its outward position, the follower fastened, the handwheel brought to the next division and so on to the end. I then broke off this worm and cast on another. After worm was chased I gave it two coats of shellac, removed the block, placed the guide and all on the flask, rammed up the mold and unscrewed the plaster pattern, inserted a core which chambered out the casting and cast it of white metal. Next, one end of this white metal was chased to receive end of spindle, which is chased left-hand four-thread, pattern being a right-hand thread. The block was then put on again and the metal pattern finished up same as the plaster one had been, with the only difference that there was but 1/64 inch to take off. I found that the sand would break at the top when the pattern was withdrawn, so I made a stripping plate, which goes between the guide and flask, as shown in Fig. 1. Fig. 2 shows a base plate which has a screw-plug fitting pattern and also fitting small end of flask. Here it is shown ready to ram up with loose core print. After being rammed it is turned over, the base plate unscrewed, the stripping plate placed on and then the guide placed on top of this and clamped in position, when the pattern is withdrawn. The top part of mold was made with a core, only one flask was used.

A ¾ Tail Center

By A. E. Rylander

The cut shows a lathe center which I believe could be used to advantage in place of the half centers now in common use. A half center hardly gives sufficient support to the work being turned, and the 90 degrees added should materially offset this defect and yet leave plenty of room in the tool. The drawing practically explains itself.



A ¾ Center

[Work so small that the center has to be cut away is light enough for the cut to lift it so that it bears on the bottom of the center, in which case it would seem that the half center is just as good as this one as they both give the same amount of bearing at the bottom.—Ed.]

The Briquetting of Metal Borings*

By Richard Moldenke †

A German method of applying great pressure for an appreciable time to cause metal chips to cohere into briquets.

No binding material is used, the combination of excessive pressure with the time interval acting to force out all air, which is the cause of disintegration of ordinary briquets when heated.

Briquets formed are of wonderful durability and can be handled and melted just like pig metal.

Improved quality of iron produced.

One of the latest developments in the metal industry in connection with the utilization of metallic waste is the process of briquetting it under enormous pressure, without the use of a binding medium.

The process in question was originated by Arpad Ronay, of Buda Pesth, who conceived the idea of imitating nature as closely as possible in the production of rock deposits. That is to say, he combined extreme pressure with a sufficiency of time to allow individual particles to get close together, excluding thereby spaces filled with air or water, which under the pressure in question would tend to weaken the bond. This is exactly what happens in nature in the formation of deposits, the very fine particles of disintegrated minerals settling down slowly and into close contact, to be later on compressed into stone by the weight of superposed layers.

When metal particles, as well as ores or other fine materials, are subjected to the ordinary rapid and heavy pressures,

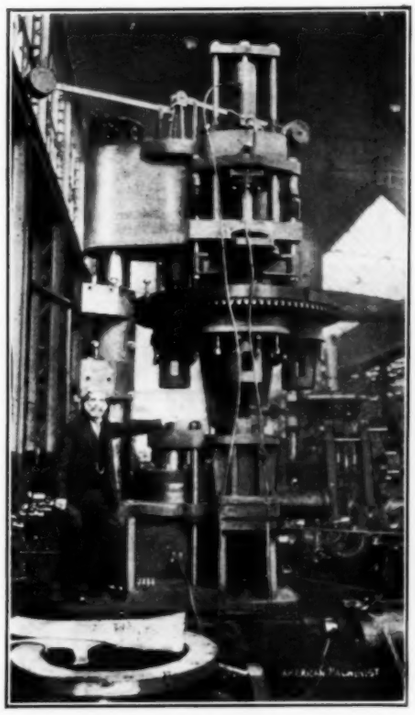


FIG. 1. NEW SIX-TON PER HOUR BRIQUETTING PRESS UNDER CONSTRUCTION FOR CHEMNITZ PLANT

enough air is entrained to give trouble when the briquets are heated up. The air expands, causing the breaking up of the briquet with consequent excessive loss and troubles incident to the use of the fine material untreated. Ronay's results were surprising in that the briquets were perfectly inert so far as their integrity was concerned, and the ores were reduced like regular lump ore, and metal briquets melted like pig iron. It is this treatment that forms the basis of the patent protection.

*Condensed from a paper presented before the May meeting of the Allied Foundrymen's Association, at Pittsburg, Penn.

†Secretary, American Foundrymen's Association.

A visit to the several briquetting installations in Europe existing at the time, showed the briquetting industry to be in a flourishing condition, and since that time more plants have been added, making ten in number at this writing. There are two in Berlin, one each in Chemnitz, Stolberg, Cassel and one at the Imperial Navy Yard at Kiel. Then there are plants in Vienna, Buda Pesth, Milan and at Winterthuer, Switzerland. In this country the Ronay process for handling metal waste is operated by the Metal Briquetting Company, of New York City.

In general the process may be described as follows: Cast iron, steel, brass, bronze, aluminum, copper chips, borings, filings and metallic slimes after drying, and for that matter saw dust, coal graphite, salt, ore, flue dust, etc., go to a hopper above the press proper. In the case of borings, it is first necessary to allow these to pass by an exhaust fan, to remove dust and dirt (also taking the very fine graphite away, which cannot be avoided when cleaning thus). Incidentally where there has been some slight rusting of the borings, the rubbing of the particles upon each other during transit, loosens the rust and this is drawn away by the exhaust, thereby greatly improving the quality of the briquet, as rust is never a good thing to go into the cupola.

In the case of steel turnings, these pass through a set of disintegrating rolls in order to reduce bulk.

FIG. 2. PRESS IN OPERATION AND PILE OF CHIPS

FIG. 3. BRIQUETS PRODUCED

When the writer was first asked to investigate the process professionally at the instance of American interests, before going to Europe to do so, he took one of the German briquets made of cast borings, and melted it in his cupola, leaving the breast open so that by means of an iron bar contact could be had with the briquet from time to time, as it melted. It was found that the lump of briquetted borings melted just as a piece of pig iron would, holding its shape until the final softening and dropping to the bottom.

After cleaning the borings by exhausting the dirt and sweepings, they pass over an electromagnetic separator, to remove brass from iron. The cleaned and separated borings now pass into the feed hopper of the press. The borings flow by gravity into the hopper, then into the die, and as the plunger descends, receive their first compression. The air passes out as the borings go together, the separate particles curl into each other, and the partially completed briquet, in the die, passes on, carried by the revolving press table to the next stop, where plungers below

and above apply pressure up to 35,000 pounds per square inch. The die containing the briquet is free to move up or down at this point, giving the compressed material within freedom to adjust itself to an evenly distributed force.

On the withdrawal of the plungers, the revolving table makes another movement, placing the die with the finished briquet within (slightly conical in shape) under another plunger, which forces the briquet out and upon a band to take it away from the machine. All these movements are entirely automatic, the valve regulation being perfect, one man looking after the operation of the press itself, another taking the briquets away, while a third sees that the hoppers are properly fed from borings received at the plant. A foreman machinist looks after the general operations, the pumps, accumulator and intensifying units.

It may be interesting to state that the briquets after leaving the press become quite hot, so that any oil originally in the borings, and that applied to the die before filling, either by a swab in hands of the man at the press, or automatically, does some smoking. Moisture present also disappears in a short while, the heat, however, not being sufficient to prevent the hand from resting on the briquets for a moment.

Fig. 1 shows a big new press for the Chemnitz plant, while under construction at the great locomotive works of A. Borsig, in Tegel, Berlin. This new press is of 6 tons per hour capacity, and automatic in every particular, thus reducing the cost of briquetting—including overhead charges, interest, labor and all—exclusive of royalty, however—to about fifty cents a ton. The cost of such a large press, with conveying apparatus and all accessories, is about $35,000, which shows to what perfection the process has been brought in Europe in the short time the matter has been before the iron industry.

In the illustration, the upper front shows the feeding hopper and packing plunger. Wm. Lorenz, of Hartford, Conn., at whose instance the writer went to Europe, has his hand on the pressing piston. The counter plunger is over this, above the turn-table. The shaft behind Mr. Lorenz, and the central shaft, are tie rods to bear the reactive thrust during the pressing operation. The vertical rod attached to the pressing piston is one of a pair of rods connecting it with another piston below, arranged for withdrawing the pressing piston after it has made its stroke. The machine as shown was then practically completed. As this press is one of the latest, a mold lubricating mechanism is included in its makeup. Fig. 2 shows a press in operation, while Fig. 3 shows a quantity of briquets produced.

The perfecting of these presses has cost probably two hundred thousand dollars and the unremitting attention of several years. Hence the state of perfection achieved, as well as the lesson learned that working out new hydraulic methods is very costly, especially when dealing with the enormous pressures in question. As a consequence, however, of the study of the minutiæ of the process, a marvelous economy has been effected, as anyone who will try the plan on existing presses in comparison will testify to when he gets tired of the expense.

The briquets produced are so uniform in weight that counting them while charging is sufficient for all purposes. They can be handled just like pig iron; in fact, they may be piled high, transported everywhere in open or covered cars, without any damage whatever, and when charged into the cupola, melt without disintegrating. An interesting side light is what can be done with a briquet of wrought-iron borings. One of these was heated up and put under the hammer, turning out a very servicable drop-forging.

While blast-furnace problems do not directly affect the foundrymen, yet it may be of interest to them to show a possibility in the line of reducing the cost of pig iron. This is the case of the famous Friedenshuette furnace — now rather old—at the junction point of Russia, Austria and Germany. The writer visited this plant and saw the ore and flue dust briquets charged into the bell of the furnace, and pieces of the lining at the hearth taken away in repair, which had portions of a briquet adhering to it partly fused at one end and the other intact, showing that the briquet went down the entire length of the furnace without disintegrating. Considering the enormous waste from flue dust dumped on the waste piles in this country, here is a chance for economy.

What will naturally interest foundrymen most is the behavior of briquets in the cupola. The writer saw a heat personally at the Borsig works in Berlin and took special note of the castings made at the time. He also saw a number of cast and other borings briquets which had been partially melted and had their shape otherwise intact, these being recovered on dropping bottom specially before the respective heats had been completed.

The use of borings in the cupola is an affair, probably as old as the cupola itself. Until very recent times, however, but little of value has resulted in this direction. Whitney and Outerbridge were the first to give results to the public, and in the days of high-priced iron, boxing up the borings in wooden containers answered fairly well. Then again, in the anthracite region it was a common thing to use old powder cans, nearly filled up with borings, the tops beated down, and the canisters charged into the cupola. Latterly an adaptation of this with the novel feature of continuous tubes filled with the borings has met with considerable success when carefully handled. All these methods, however, may be described as "fussy" even if effective, one works using all the old cans that could be obtained until the supply gave out. With the briquetting method, however, which aside from the royalty question, is the cheapest of them all, a new era was commenced, for the melting loss was reduced to a minimum, no apparatus was needed after the material left the press room, and the ordinary conduct of the foundry was in no way disturbed.

On the question of cupola practice, therefore, the use of briquets simply parallels the use of pig iron and heavy scrap, and inasmuch as the briquets, in spite of the enormous pressure, are not fully as solid as pig iron, they melt somewhat easier and faster than it, and from their handy shape and weight, form an ideal cupola charging and melting material.

Whereas borings when charged directly into the cupola lose all the way up to 50 per cent. of their weight, besides ruining the product; when they are boxed, canned, or melted in tubes, the melting loss is not excessive, varying between 8 and 12 per cent., the danger always remaining that the cans or tubes will open and by discharging the loose borings over the coke bed, ruin everything that follows until they are burned or melted and washed out.

In the case of briquets, as in every other melting test made to get figures on a process, much depends upon how the melting is done. For instance in melting straight pig iron with small precautions to get the very best melting practice, the melting loss may amount to 3 per cent. and even over. Where, however, these precautions are taken, repeated tests have made this loss about 1 per cent., and in the case of sandless pig, as low as 0.3 per cent.—some carbon having probably been taken up during the melt. Hence also in the case running straight heats of briquets, the melting loss with practice that gave 2.5 to 3 per cent. loss for straight pig iron, gave 8 to 10 per cent. for the briquet loss. With careful practice, however, there is no difficulty in getting this down to 6 per cent.

As, however, no one would think of running a straight heat of briquets, for daily practice, but charge all the way from 10 to 80 per cent. of these articles, the rest being pig iron and scrap, the melting loss of the heat will be about the normal one. In the case of a heat made with 80 per cent. briquets and 20 per cent. pig iron, the actual melting loss was only 3.5 per cent., showing either more careful practice, or else that the comparatively heavy pig iron held the temperatures in the cupola more sharply localized, doing the melting

where wanted without oxidizing what was above.

In the calculation of expense when using briquets—inasmuch as these would form but part of a charge, the factor of extra loss from melting them can be altogether neglected.

Metallurgical Changes—Mixing Steel and Cast Borings

There are some metallurgical changes in melting borings, whether loose or briquetted, which must be reckoned with. In melting a material which has such an enormous surface for a given weight, and which even when compressed practically solid to remove the disadvantages of the disproportion in question, can still be permeated by gases to some extent when expanded by heat, certain changes necessarily take place. The silicon will be lowered considerably more than is the case ordinarily; similarly the total carbon, while the sulphur taken up is about double the ordinary increase. This, of course, is particularly noticeable only when an entire heat of briquets is to be reckoned with. Under ordinary conditions with part briquets only there is little difference noticeable, and for such work as cylinders of gas and steam engines, ammonia castings and the like, there is marked improvement on the part of the castings produced. This may be understood more readily by remembering the fact that a reduction in the total carbon and silicon corresponds to a steel addition to the charge. The slight increase in sulphur means a structure more finely granular, and hence a better wearing surface for cylinder work. Inasmuch as the large locomotive works of the Continent are adopting the use of briquets, and when proper melting practice prevails, the castings made are perfectly sound and free from blow and pin holes, it is evident that the use of borings in the way described is not a detriment. In fact, strange as it may seem, in Germany these briquets are actually sold at pig-iron prices, and at the Borsig works, for instance, the regular charges for steam and gas-engine cylinders, and other engine parts; refrigerating machinery (ammonia and sulphurous acid); hydraulic machinery and air compressors; superheated steam and steam turbine apparatus; contain 40 per cent. of briquets.

Be it noted further that when mention is made of extra silicon and carbon removal, and sulphur increase, that this is more noticeable with imperfect cupola practice. In such cases even the ordinary run of work will show abnormal results.

Perhaps one of the most interesting applications of the briquetting process lies in the ability to mix steel with cast borings. Here is a most excellent way of charging steel into the cupola without burning up a portion of it before melting. The contact of a low carbon with a high-carbon material means the melting down of this combination with an average carbon content. In place, therefore, of adding 40 per cent. steel scrap to the charge and in melting get perhaps a reduction in carbon in the castings corresponding to half of this as a result, either much less steel need be added to the borings for briquetting, or if the full amount is added, a much stronger metal is obtained. A founder can, therefore, not only utilize any steel scrap he may produce efficiently, but actually order or make his briquets with just the proportion of scrap he wants in them.

In the case of all steel briquets it may be said that for air or open-hearth furnace work, these excel the regular heavy steel scrap in point of working. Not only do they melt faster, thereby shortening the heat considerably, but from the uniform size and shape, they pile nicely in the furnace, allowing a better circulation of the gases to melt them, than can ever be obtained by irregular and large scrap pieces.

The briquetting of brass, bronze, aluminum, white metal, and other metals has not been touched upon, but it may be said that with these the melting losses are the same as the solid metal when melted, for in the case of all the softer metals and alloys, they are pressed together so closely that they are for all practical purposes sound pieces of metal. The finer the scrap the better the briquet, and hence a magnificent field has been opened for the economical recovery of the expensive metals in the foundry.

The near future will see a rapid development of the art in this country, and it is expected that other metallurgical reactions, such as de-sulphurization of iron, recarburizing metals, and other desirable processes will be presented to the metal industry through the agency of this new briquetting process under enormous pressures and proper time conditions.

Finishing Handwheels on a Grinder

By C. A. Heald

The accompanying illustrations show the construction and means of operation of a fixture devised for grinding the outside rims of handwheels.

Fig. 1, taken from the work side of the grinder, shows a completed handwheel on the fixture, *A* being the stud about which the swiveling part of the fixture is revolved, and *B*, the base of the fixture.

Fig. 2, taken from the rear of the grinder, shows the mechanism more in detail. Base *B*, screwed to the carriage of the grinding machine, is of rigid construction and carries the swiveling stand and arbor bearing *C*. A segment is secured to the base plate, the swiveling of the handwheel being effected by the travel of pinion *D*, around the segment. For revolving the handwheel which is secured to the projecting end of the arbor and also for swiveling the stand *C*, a small countershaft is provided with a drum long enough to accommodate the travel of the belt while the fixture is swiveled around stud *A*, which stud is located exactly below the center of the rim to be finished.

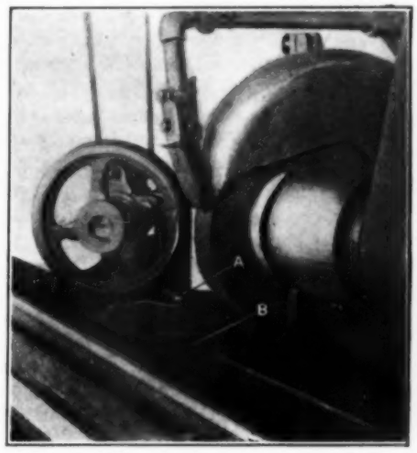


Fig. 1. Finishing Handwheels on a Grinder

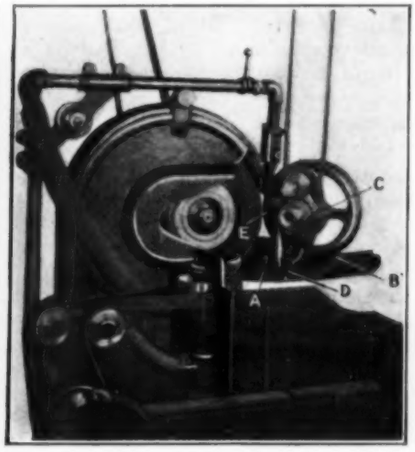


Fig. 2. Some Details of the Mechanism

The arrangement for swiveling the fixture about stud *A*, will be understood by noting that pinion *D* receives its motion from wormwheel *E*, and in revolving travels around the segment. Pinion *D* is provided with a small knob by which it can be raised out of mesh with the segment at any point of its travel, permitting the fixture to be revolved about the pivot stud *A* without using the pinion if desired, and also for returning the fixture to the starting position.

The saving in time by this method is considerable, as the grinding machine takes the wheels with their rims just as they come from the foundry and leaves them nicely finished at one operation.

The State of the American Machine Tool Market in Japan

By John S. Nicholl*

During the last few years much has been written on the industrial progress of Japan. It is only natural to infer from this that there has been a demand for machinery of all kinds, and especially for machine tools, which are the essentials of any manufacturing establishment. In America, there has been a decided tendency among machine-tool manufacturers to gage the normal requirements of Japan for machine tools at the figures set during the years of the late Russian-Japanese war. This is entirely misleading as at that time the Japanese were so much in need of machine tools and machinery of any and all kinds that they purchased from those who could deliver at once or on the shortest possible delivery. It made no difference whether the machine was made in America, England, Germany or France; they had to have it and that was all there was to it; it was not a question of price.

It so happened that at that time the United States manufacturers were not overburdened with orders and as a consequence American houses received fully their share of the business.

During the last five years or so the Japanese themselves have undoubtedly made a big hole in the importing-machine-tool trade as they have successfully made machine tools which are good enough for certain work and certainly good enough for the Japanese.

With the commercial Japanese it is not a question of quality and endurance but solely one of price. The Japanese manufacturers in the machine-tool line have made shapers, drillers, lathes, gear cutters, slotters, millers, punch and shears, planers, bench millers, grinders, and in fact, all the ordinary machine tools. These machines are usually finished very well, and, whether they will outlast the American machine or not, the fact remains that they have taken away at least 60 per cent. of the importing business from the United States.

Preference Given Japanese Tools

Perhaps one of the most prominent reasons for the decline of the machine-tool business in Japan is that all of the government dock yards and arsenals have received strict orders from the Imperial Government to allow Japanese machines to be substituted at any tender calling for a certain machine tool. It is an open question as to whether the Japanese with their cheap labor can make a machine tool as cheaply as we can in America, where jigwork and a large output are found. But with the interest, insurance, freight and landing charges amounting to 10 per cent. via the Suez Canal route and with a duty *ad valorem* of 15 per cent., the American tool is put absolutely out of running. Besides, the Japanese are quite content with 5 per cent. profit as manufacturers,

The Japanese government has cut down tremendously on all appropriations for the army and navy. This is a big blow to machine-tool importers, as the government has always been their best customer. While they are slow to make payments for deliveries, and careful to see that the goods are strictly in accordance with specifications, the orders are of a large amount and the agents can afford to take them even on a small margin, just to keep things going and to hold the agency. The government at the present time is talking about large naval and military expansions, but this has been in the air for the last two years.

Germans Born Machinists

The decrease of our machine-tool trade in the East, and especially in Japan, has been due to some extent to the increased activity of the Germans. The Germans seem, after all, to be the born commercial people of the world. Somehow or other, they get in and stay, as they are familiar with the export trade in all its phases. The German manufacturer will send one of his young men to Japan to act as his agent. He will be content to live in semi-Japanese style, so that he can live cheaply and is, therefore, an inexpensive agent. His work is not interrupted by any high club life. He usually learns the language and, above all, is there to stay. With the average American, the sojourn in Japan is strictly a sojourn. The American is usually out there for "only three years," and does not "wish to die there." Now, under such conditions it is impossible for him to get really into the work and to secure the orders the way the Germans can.

As far as the Englishman is concerned, he usually goes out to Japan to stay, but the trouble is that he is usually too fond of the social life and the customers do not get the attention they should.

As for German and English machine tools, it is known that they generally make cheap machines and usually heavier than the American does. They also build accurate machines, but one thing they do that the American does not, and that is, that they take an order for any machine tool and make it in accordance with specifications, as issued by the Japanese. The American manufacturer, on the other hand, has his standard product and if the agent cannot secure the order for this, they are willing to let it go. The agents for American houses even refrain from bidding on account of the fact that they can only offer the standard machine.

Why We Lose Orders

Of course, a large number of orders get away from American houses on account of the delivery dates. We have so much domestic business over here we have little time for any export business. We just take what we can get without any trouble and let the rest go. In Japan the government contracts are usually taken on a time limit with a stated fine for each day late, though recently this has been changed at some arsenals to a fine of 10 per cent. of the amount of the contract regardless of the lateness of delivery. The government also retains the right to reject any machine tool that is delivered late.

The overland rate from America is so much in excess of the Suez Canal route, that it is usually impossible to take an order, with competition, by the overland route. Where it is a question of Suez canal, the time in transit is usually four months, against 2½ or three overland. On the other hand, from German and English ports by Suez Canal, it is usually only two months, with a splendid fortnightly service on many lines.

A Small, Steady Demand for Machine Tools Likely

From what has been said, I do not wish to give the reader the idea that there is no demand for American machine tools in Japan. There is a small demand and it will always continue, but it has been reduced to the point where it is hard to make it pay. In the last few years a number of machinery houses in Japan have failed, and those that have not have had to be content with breaking even, but the times are getting better. There will always be a small demand for such machines as high-grade millers, gear cutters, standard gun-making machinery, planers, large-sized grinders, etc., and from time to time orders for special machinery, but in the general machine-tool lines, such as lathes or vertical drillers, the business is practically dead and there will not be much forthcoming for several years at least.

The geographical situation of Japan fits her admirably as the industrial center for the Far East and the time will come when she will hold this position. This means that there will be an increased demand for machine tools, but by that time the Japanese can probably take care of these orders themselves.

Of late the tariff on machine tools has been reduced from 15 per cent. *ad valorem* to a tariff, according to weight. Inasmuch as American machine tools are generally lighter for the same sizes than English or German machine tools, the American agents see in this a ray of hope for increasing their business to some extent anyhow.

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Filing Drawings and Storing Patterns

By Roy Ward

A system, including a simple card index, applicable to machine-tool building.

Each size and type of machine is given a number, this being marked upon all drawings and patterns for that machine.

Under this number, each drawing has a sub-number, in consecutive order, and each piece of any kind has a similar sub-number which, for castings, forms the pattern number.

The problem of planning a simple and comprehensive, yet elastic method of filing drawings and storing patterns, and keeping a record of the location of both, has resulted in the installation of a great variety of systems. Some of them are so complicated that it requires all of one person's time to find reference drawings for the draftsmen, file the new ones as they are made, make out the index cards for them and file them in their proper place.

A system of this kind usually is found where a large number of draftsmen are employed and it is undoubtedly cheaper to employ a young man to look after this part of the work than to have the draftsmen do it themselves. As these large drawing rooms are in the minority, the average draftsman has to do this work himself.

Under these conditions and where no hard and fast rule is in force, each man may consult his own judgment as to where a drawing should be filed and as to the way the index card should be made out. The result of this is that in many cases no one can locate certain drawings but the one who made them. As this person may have gone his way, a great loss of time sometimes results in locating the desired drawings.

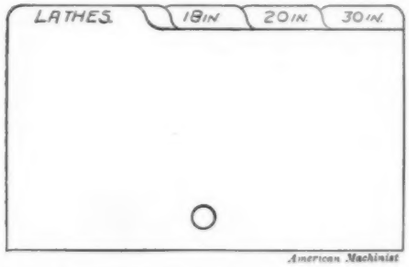


FIG. 1. DIVISIONS OF THE LATHE CARD INDEX

The primary object in planning a system for the purpose named should be simplicity. By simplicity is meant that the method of filing the drawings, storing the patterns, making out and filing the index cards for the former and the record for the latter, should be so simple that anyone with a working knowledge of the card index could find either drawings or patterns without any trouble. The second object should be to make it as comprehensive as possible without destroying its simplicity and, last but not least, it should be elastic enough to cover any future conditions that may arise. A system embodying these three features will prove satisfactory both to employer and employee. Such a system has been found in operation by the writer, and by following this description the advantages over many other systems will make themselves evident

APPLICATION TO FILING OF DRAWINGS

I shall describe first its application to drawings. Each machine, different in size or construction, as soon as the design is started in the drawing room, is given a number. These numbers should be taken consecutively and are the means of identifying its various pieces in the shop. For illustration; suppose we take

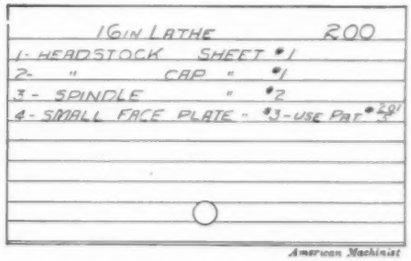


FIG. 2. SAMPLE INDEX CARD FOR LATHES

a firm that manufacturers lathes. Their 16-inch lathe will be numbered, say 200; their 18-inch lathe, 205; their 30-inch lathe, 300; and so on. These numbers apply to their standard make machines only. If a customer desires a lathe to suit his special requirements, it is given another number, although it may be a stock size.

Each drawing of a machine bears its own particular number in the lower right-hand corner, and beneath it the number of the sheet. Each sheet is numbered consecutively as it is finished; for instance, sheet number 5, of the 16-inch lathe, would be numbered $\frac{200}{5}$. Two sheets with the same machine number are not, under any conditions, to be given the same sheet number. The sheets of one machine, as will be observed, may all be filed together in their consecutive order.

If the practice of the office is to make large drawings and file them in drawers, a good way to file them is to make a folder of good wrapping paper, slightly larger than the drawings, and place them in this, marking on the outside the name and number of the machine it contains. If small sheets are preferred, they may be kept in book form in a loose-leaf cover which should bear the numbers of all the machines it contains. The drawers in which the large ones are filed should also be numbered similarly.

Each detail, whether it is a casting, forging, or otherwise, is given a piece number which is marked under the machine number. For example, suppose the headstock of the 16-inch lathe is numbered 1 and the spindle 2; the piece numbers would be $\frac{200}{1}$ and $\frac{200}{2}$. These lower numbers also should be taken consecutively.

THE INDEX

The record of all the drawings on file is kept by means of a card index. This

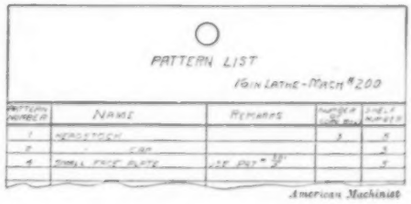


FIG. 3. PATTERN LIST FOR ONE LATHE

is divided into as many parts as there are classes of machines, the name of each class being marked upon a guide card. Back of each guide card are arranged the cards of the various machines, according to their size or other distinguishing features. Each of these has its own sub-guide card bearing its own name. This is illustrated in Fig. 1.

When the first sheet is completed, the first index card for that machine is made out as follows: On the top line is marked the name of the machine; in the extreme upper right-hand corner is printed or stamped the machine number; at the extreme left edge are the piece numbers; following each piece number is the name given to that particular piece, and following this is the number of the sheet on which the detail drawing may be found. It will now be seen that if the drawing of a particular piece is wanted, the sheet containing it can be readily located by means of the index, instead of looking over each sheet until it is found.

If a pattern belonging to another machine is used, the note: "Use Pattern No. —;" whatever it may be, should be placed after the name and a similar note made on the drawing. Fig. 2 illustrates how a card, as described above, should be made out. This set of cards should be cross-indexed by means of another set bearing nothing but the number and name of the machine, so that, if only the number is known, the name may be ascertained.

Aplication to Patterns

We may now consider the application of this system to the pattern loft. In storing the patterns the same method is followed as with the drawings. The patterns as they are finished have their piece numbers stamped upon them, which also makes it the pattern number. All patterns having the same machine number are stored together. The extra large ones, such as beds, housings, tables etc., may be placed where it is most convenient.

In keeping a record in the pattern loft, sheets 9x18 inches are used. These sheets contain the machine number and piece number of each pattern. They also contain all other necessary information; such as, use of another pattern, number of core boxes. etc. After all the patterns are completed, these sheets are mounted on heavy cardboard and shellacked. A hole is punched in the top for convenience in hanging up and they are then hung upon the wall in their respective groups. Fig. 3 shows a specimen of these cards.

If the patterns for any machine are to be sent to the foundry, all the man has to do is to take the card and get out the patterns named thereon.

Rapid Automatic Screw Machine Work

We recently ran across an interesting example of the way in which the production of automatic screw machines has increased within the last few years. In order to determine just what output was entirely practical in these days of high-speed steel, the Cleveland Automatic Machine Company have been running an experimental department and have surprised themselves with the amount of output which can be obtained when proper tools are used, and the work is handled so as to secure best results.

A careful study has been made of the time required for each operation, and the output is being figured on a 10-hour run in order to have it thoroughly practical in every way.

On hexagon-head cap screws, one inch long under the head, and with United States Standard threads, the output is shown in Table 1. This divides the operation into milling, threading and shaving, and the time is given in each case in the seconds required per inch. The speed of threading is very fast, both 3/8- and 7/16-inch cap screws being threaded at the rate of 20 inches per minute, and the 1/2-inch cap screw at slightly faster than this.

The milling time given is with the roller-rest box mill made by this company, having a single cutter and making but one cut over the piece. There is also a square tool post and cutter to form the head, and a self-opening die. It was found that with the hexagon bolts, and with square-headed cap screws having the same-sized body, the milling time was 40 per cent. longer than for hexagon-head cap screws. In the case of the bolts it is because of the greater sizing accuracy necessary, and in the square-head cap screws, on account of the extra stock which must be removed

Set Screws

The time required for set screws is shown in Table 2, the time being based on three-hole turret machines, fitted with double cross slides and double-belt spindle drives. The milling time considers the same roller-rest box mill as before, and the same tool post and self-opening die. By using high-speed hollow mills, it is possible to decrease the milling time about one-third, owing to the fact that at least two of the teeth will cut, but the surface will not be as good as with the box mill. Where the work is to be threaded, it is not important, but for bolts, where it is desirable to hold the body size within close limits, the hollow mill is not as dependable as the box mill.

Making Nut Blanks

The turning and drilling of hexagon nuts is shown in Table 3, which does not include tapping. This is because it has been found more economical to tap nuts on a special machine, where the blanks are fed automatically into a hopper.

The drilling spindle in this case is revolved in the opposite direction from the work, in order to secure the proper cutting speed for the drill, and in this way to largely increase the output of the machine. These are done on a plain machine with double cross slides and geared high-speed drilling attachment.

Threading Studs

In the making of threaded studs it has been found more economical to use a plain machine for breaking corners and cutting off the stock, when cold-rolled steel is used, as seems to be the best practice.

The studs are then threaded in another machine, fitted with a magazine. By the use of a vertical magazine these pieces are very readily handled for the threading operation, the time required depending upon the length of the thread, as can be seen in Table 4.

Where they are made from black stock it is recommended that a hollow mill be used to make one cut over the body, the necessary time required for milling being shown in Tables 1 and 2. As the finish is not particularly important, the regular hollow mill can be used, so that between 6 and 7 inches per minute can be milled on 1/2-inch studs.

It is also well to note in all of these operations that the milling time was to be considered, as it requires longer than the other operations.

Size of screw	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"
Output per hour	95	90	73	67	53	48	45	40
Milling, seconds per inch	15	15	14	16.5	17.5	20	21	22
Threading, seconds per inch	3	3	2.7	3.2	3.1	3.2	3.7	4
Shaving, seconds per inch	10	10	11	13	15	17	18	19

TABLE 1. HEXAGON HEAD CAP SCREWS.
1" Long under the Head. U. S. S. Pitch of Thread.

Size of screw	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"
Output per hour	90	86	83	73	65	54	45	38
Milling, seconds per inch	12	11.5	12	12.5	13.5	15	16	16.5
Threading, seconds per inch	2.4	3	2.6	3.2	3.3	3.2	4.1	4

TABLE 2. SET SCREWS.
1" Long under the Head. U. S. S. Pitch of Thread.

Size of nut	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"
Output per hour	310	280	240	210	180	150	115	90

TABLE 3. STANDARD HEXAGON NUT BLANKS.

Size of stud	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"
Cut off per hour	150	360	300	260	240	180	150	125	100	80	60
Threading, seconds per inch	1.8	2	2.7	2.3	2.3	2.7	3.3	3.5	3.7	4.2	4.2

TABLE 4. STUDS. U. S. S. PITCH OF THREAD.

A good practice in foundries, where burns are frequent, is to put on thick soap suds. It beats all the patent compounds ever gotten up, and besides soap is obtainable anywhere at any time. The lather keeps out the air and draws out the inflammation. After a few minutes the burn, if a bad one, may be wrapped up, but if just an ordinary burn, an occasional application of lather is all that is needed.

Titanium in Iron and Steel*

By Charles V. Slocum

Effects of a small percentage of an alloy of this element in producing fluidity, sharp castings and developing uniformity and durability.

Proportions used in basic open-hearth steel.

*A paper presented before the American Foundrymen's Association.

It was the idea at first in using titanium in iron that since comparatively large percentages gave increased strength in tensile and transverse tests, that these large percentages were essential to the process of securing a titanium reaction in the metal and therefore must be used. Gradually, however, it became evident that minute percentages of titanium were successful in producing many of the benefits of a large quantity. As, for instance, the use of two-tenths of 1 per cent. of alloy which contains only 0.02 of metallic titanium is frequently sufficient for the purpose desired, which consists principally of cleaning the iron of impurities remaining in the metal after the ordinary fluxes have accomplished all that they can in this direction. This cleansing is not one which is possible with limestone or with fluorspar, for these fluxes have no effect whatever upon the oxides or nitrides contained in the molten iron.

Titanium, on the other hand, removes both of these objectionable elements partially in any event and wholly or practically so when sufficient alloy is used for the purpose. The effect then of the small fractions of a per cent. in iron is, more practically speaking, to increase the fluidity of the iron and at the same time to make the metal more homogeneous, so that the resulting castings are closer grained, are free from pin holes and gas bubbles or blow holes, the iron has a denser structure and at the same time is easily machined.

The shrinkage is less in the treated iron than in the plain or untreated casting. This is particularly true in hard or chilled iron, here heavy castings, such as car wheels, will shrink an eighth of an inch less or one whole tape number in circumference.

Much finer work may therefore be done with iron treated with the alloy, since the casting will conform more nearly to the original pattern and will have a more uniform shrinkage than the plain iron.

In a letter dated April 5, 1911, the writer was advised by Asa W. Whitney, metallurgist of the Enterprise Foundry and Machine Company, of Bristol, Va., that he has made a number of careful trials of titanium in hard or chilling iron. He finds that 0.1 to 0.2 per cent. of the alloy is usually all that is necessary to make otherwise viscous, high chilling mixtures come from the cupola close grained and pour from the ladle as freely as iron carrying half as much chill and of more open grade. The iron pours well to the last and gives clean solid castings. "I find," Mr. Whitney says, "that I am able to compensate for the cost of the titanium with less manganese and a trifle less silicon."

To foundrymen the fact that the metal remains hot longer than untreated iron is a matter of much importance for certain classes of work, since the greater fluidity means that the iron will settle more slowly in the mold, and thus give time for the gases to escape and more time for the iron to fill every smallest outline of the mold without pulling away from the main body of the casting. These features of good foundry practice are some of the ones which are often overlooked, and a high percentage of bad work results. Now, in relation to the benefits to be expected from using larger proportions of alloy, I maintain that a great deal of undue importance is often attributed to an increase in transverse and tensile strength. This may be necessary for certain government work and for some few castings which must resist unusual stresses in service, and for such it is necessary to use at least 1 per cent. of titanium alloy.

My contention is, however, that such a percentage is not only a serious increase in cost per ton of product for ordinary castings, but in all the practical uses to which most castings are subjected no special increase of strength is required, although an improvement in quality may be absolutely necessary. We have in mind a recent case where the castings in a certain foundry were stronger than necessary, were well made and were satisfactory to the foundry superintendent and to his customers, but when he tried the small quantity of alloy usually recommended for such cases merely for the purpose of improving the fluidity of the molten metal and the density, machining quality and durability of the casting, he found that the machine shop of one of the great railroad companies which turned up the castings, reported that these treated specimens (piston rings) were closer grained, were more like steel and were more desirable for their purposes. Yet of the four test bars cast, one of untreated iron was strongest in transverse strength.

On the other hand, a large manufacturer of my acquaintance having a ten-ton casting to make and being anxious to have no failure in so important a job, added 1 per cent. of titanium alloy and secured a splendid casting which may have cost him $25 extra for all the alloy used, but which made a sure thing of a single part of the machine worth at least $400 even without including the machine.

To summarize these statements then, it may be said that titanium alloy is of great benefit, in small percentages, for fluidity, for sharper castings, for remarkable uniformity and for durability, while the larger percentages are for strength and density of metal in addition.

I realize, of course, that certain classes of work do not justify an increase of cost to any extent worth mentioning, and yet even in cheap work the use of a pound or two of alloy per 1000 pounds of iron is a distinct benefit to the metal and costs but 25 to 50 cents per ton of product. Other classes which will perhaps bear a little more expense may be increasingly benefited with three or more pounds per 1000.

In conclusion the uses of titanium in iron may be summarized as follows:

Very small percentages, as low sometimes as 1/10 of 1 per cent. (0.1) of alloy (only 0.01 Ti), are sufficient to cleanse the iron of impurities not touched by limestone or fluorspar, while larger percentages increase the improvement in other directions, making the iron more fluid (usually hotter), making the castings sharper, finer grained, free from blow holes and pin holes and easily machined, while at the same time the expense runs from 25 cents per ton of castings up to say $3 as a maximum, all of which is often repaid in the reduction of bad work and in improving poor irons.

In steel castings the same principles may be said to hold good. In order to secure increased fluidity and ductility of the steel, the small percentages of alloy such as one- or two-tenths of a per cent. have been used successfully by a number of manufacturers and for a further increase of ductility, density and greatly increased strength, the larger percentages from three-fourths up to 1½ or even 2 per cent. are extensively used.

It must be remembered that the smaller proportions are not sufficient to give the full benefit of which titanium is capable, any more than a small dose of medicine is capable of doing what a more powerful one might be expected to accomplish. When we make a decided effort to improve any material it is always necessary that some good judgment be used

in connection with it. For instance, what good would it do to add a certain percentage of manganese to the slag? And yet the writer has several times seen the usual deoxidizers added so late that a further deoxidation by the use of titanium was wholly impracticable.

When the attempt is made to purify steel by any method whatever, several requisites are necessary and mention is made of some of them here for the sake of a more general understanding of what we are trying to explain in this paper. In the first place practically all steelmakers endeavor to fully deoxide their steel by using more or less of the well known deoxidizers, manganese and silicon. These two factors are known in every mill of any merit the country over. The melters try to remove other shortcomings with these elements also. For instance, the metal is sometimes overmelted and then the melter tries to bring the steel back to normal conditions by putting in more manganese or more silicon or both perhaps, occasionally making the steel too high in these elements to pass the specifications or too full of blow holes to pass the shop inspection. Sometimes one of these same heats thus spoiled is one in which titanium is later added and the failure is charged to the latter, i.e., to the element which could have saved the heat had it been used in sufficiently large proportions of say 1 per cent. or more and in sufficient time.

One great advantage in the regular use of titanium alloy is that it removes those features of irregularity which have given steel a bad name for its unreliability in a number of directions. It would be out of the question to secure as uneven or irregular results in any mill when using titanium regularly as is frequently known to be the case without it. Heat after heat has been made with the addition of titanium in regular practice and when the chemical analysis of the mix has been practically uniform, the results have been equally good.

So many manufacturers have now used titanium with success as a cleanser of steel and iron that it is needless to speak of this point further beyond merely stating that it is useless to experiment with any material whatever under anything except normal conditions, for otherwise the results become abnormal and perhaps may never be duplicated even if desired.

In a recent trial of the alloy in basic open hearth by one of the large steelmakers, it was found that in order to remove the last vestige of brittleness and of blow holes, the use of 1½ per cent. of alloy was necessary. This in turn made the steel so dense that it was unusually strong and became the source of much comment and investigation by all concerned. It is not possible to remove all of the causes of poor castings by the addition of titanium nor with any alloy whatever. Good foundry practice is more necessary in steel than in iron because more harm is likely to result if the castings are not as good as they should be. When the mold is not properly made or baked; when the mix is not properly figured and prepared; when the melt is not looked after to prevent overheating, etc., it all comes back to the original statement that other things are necessary as well as the use of alloys, for good steelmaking.

When we learn that in some mills a sinking head is cast which weighs considerably more than the casting itself and the latter in some instances weighs eight tons, then we see at once that foundry practice has given way to the sink head and it is a wonder the casting itself does not give way as well.

When we take into consideration the fact that so small a proportion as one-tenth of 1 per cent. of titanium alloy makes a noticeable improvement to steel as vouched for by some of the largest steelmakers in this country and that larger proportions up to say 2 per cent. add materially to the improvement, then it becomes clear that the small cost involved which runs from 25 cents as the minimum up to $5.60 per gross ton of product as the probable maximum, is something which every steel mill may well take into consideration and begin to save money by reducing their percentages of bad work.

The following proportions have been used regularly in a well known steel mill where only the best results are accepted and where the product is said to be equal, if not superior, to the best stamping steels made in this country:

BASIC OPEN HEARTH STEEL

Size of heat, 120,000 lbs.

	C.	Mn.	P.	S.
Analysis	0.10	0.33	0.007	0.019

Titanium alloy added in ladle, 250 lbs. = 0.21 per cent., or 0.021 Ti.
Aluminum added, 10 lbs. = 0.01 per cent.
Elastic limit, 37,060 lb. per sq.in. } after dead soft anneal.
Tensile strength, 44,920 lb. per sq.in. } after dead soft anneal.
Elongation in 2 inches, 40 per cent.
Elongation in 4 inches, 28 per cent.
Reduction of area, 56.4 per cent.
Fracture, silky.

In the mills of one of the most scientific steelmakers in the United States, steel castings are required of the following specifications:

Elastic limit	45,000 lb. per sq.in.
Tensile strength	85,000 lb. per sq.in.
Elongation after rupture	12 per cent.
Contraction of area	18 per cent.

"These specifications have been met and the necessity for numerous heat treatments have been avoided by the use of eight pounds of titanium alloy per ton of metal (= 0.4 of alloy or 0.04 Ti) added in ladle. No aluminum was used."

These parties write as follows:

"Comparing the results of the tests made upon specimens after the first anneal, of the last fifteen heats in which ferrotitanium was used, with those of the last fifteen previous heats in which it was not used, it appears that the mean tensile strength was increased from 81,633 pounds per square inch to 91,533 pounds per square inch, that the mean elastic limit was increased from 47,233 pounds per square inch to 50,000 pounds per square inch, that the mean elongation was increased from 15.1 per cent. to 19.2 per cent. and that the mean contraction of area was increased from 18.9 per cent. to 24.3 per cent."

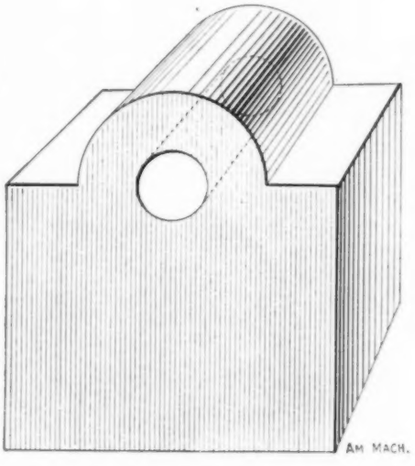
In a letter dated April 12, 1911, J. H. F. Dixon, general manager of the Keystone Steel Casting Company, of Chester, Penn., makes the following comment on the use of titanium alloy in their steel castings:

"The added cost of the production of our metal by the use of this alloy is so slight that we are prepared to furnish genuine crucible castings titanium treated, at the same schedule of prices which apply to our carbon steel. We strongly recommend," he states, "the use of steel so treated for automobile work, where the castings are subject to unusual shocks and where uniformity of the material is absolutely essential."

Machining Circular Sections in a Shaper

By George W. Cooper

I use very frequently the following method in making a piece of work that has a partly circular shape, as shown in the cut; the operation of making the half-circular part being all done in the shaper: A good fitting pin is inserted in the hole shown, the pin being slightly longer than the piece, and the end of this pin is then placed in the jaws of the shaper vise, leaving the work to swing free. The piece is then turned about the pin and cut after cut is taken off until the work is finished.



Machining Circular Sections on a Shaper

Oversize Standards for Pistons and Rings*

By James N. Heald†

For several years past the automobile and gas-engine manufacturer has been so busily engaged in the development and perfecting of his machines and meeting the demand upon him for his product that he has, up to the present time, apparently given very little thought to the ways and means for reducing the cost of maintenance among his customers, as well as for preventing the delays so frequently met with in repairs that are required from time to time.

Thousands and thousands of people all over the country have taken up the automobile very enthusiastically, but there are many users of cars today who can ill afford them, due principally to the cost of upkeep; and after a time they cease to be purchasers of cars and equipment. There are so many expenses connected with the running of a car that it would seem a desirable thing for the manufacturer and the repair man to adopt any plan by which the time and expenses of making repairs to an engine are reduced to the lowest point.

Many of the engines are now made with cylinders cast in pairs, or *en bloc*, and an imperfection in one cylinder bore makes it necessary to throw away cylinders in which the other bores are in perfect condition, in fact, in better condition than any new cylinder which will come from the factory can be, because the old rings and pistons will not usually fit the new cylinder as well, and in any event the new cylinder is comparatively rough, and does not have such an excellent bearing and contact with the rings.

For that reason the ability to refinish a cylinder by the repair man is most desirable and means a considerable saving in time and money to the owner of a car. The advantages of being able to refinish cylinders are not confined to those which have become scored up in running, but apply equally in the case of ordinary wear, which is found in all engines after running ten, twenty or thirty thousand miles.

In this case the refinishing of the cylinders and the substitution of new pistons and rings also means the putting of the engine in first-class condition at a minimum cost.

The refinishing of a cylinder bore can be most easily accomplished by the use of a cylinder grinder, such as have been used for a good many years by almost all the leading concerns in the manufacture of automobile and gas engines.

Using Old Cylinder of Enlarged Bore

Occasionally in refinishing a cylinder the scoring is so slight that an increase in diameter of perhaps 0.005 or 0.006 inch only is necessary to produce a perfect hole. In such cases it is often considered a question whether a new piston is necessary, and frequently customers will decide to use the old pistons, together with a set of rings which are made enough larger to make up for the increased diameter of the bore. Just how much larger the bore can be made than the standard size and have the old piston prove satisfactory to the average user is a debatable question.

When there is much difference in size between piston and cylinder, of course, the opportunity for leakage of gas through the cut in the ring is increased, and it becomes more difficult to maintain compression. It therefore seems desirable to make new pistons and rings to secure a quiet running engine when any considerable amount of stock is removed in the refinishing of the cylinder bores.

From our experience we would set the limit of increase in size to 0.005 or 0.006 inch if the old pistons are to be used.

Getting Oversize Pistons

New pistons being decided upon, the question comes as to securing these, very few of the manufacturers of engines being prepared to furnish anything but the standard-size pistons.

They are also not particularly anxious to furnish rough castings to the repair man to be used in making pistons of oversize dimensions, and even if they were, too much time is required to send to the factory to secure these. For that reason the job shop is called upon to make a pattern for a piston and to fit up the castings. The cost of the pattern is a variable quantity; if a good many castings were wanted, of course, it would pay to make a reasonably good pattern. but if there are only one or two pistons wanted, as is usually the case, one feels like making a pattern as cheaply as possible.

Oversize Standards of Pistons and Rings Desirable

It seems that the adoption and furnishing of certain oversize standards of pistons and rings would be an extremely desirable thing for the manufacturer of engines to arrange. In the first place, the manufacturers have the correct patterns; they have the jigs and equipment to make these pistons and rings correctly and economically and to the proper weight and size, so that the piston pins, bushings, connecting rods, etc., are all interchangeable.

The agent in any town could at very slight expense carry a small stock of these pistons and rings of 0.010, 0.020 or 0.050 inch oversize, according to what standards and how many were adopted. Then it would be easy in the case of a scored cylinder, for the repair man to simply have the one cylinder bore refinished to 0.010, 0.020 or 0.050 inch over standard size, and the engine could at once be reassembled with the new piston and rings with the least possible delay and expense for this work.

The pistons could be made to weigh exactly the same as the standard piston, and therefore a new piston assembled in an engine would run as smoothly with regard to weight of reciprocating parts as was the case when the engine was first assembled.

I understand that at the present time the Pierce-Arrow Motor Car Company (and possibly others) is furnishing these oversize standards in 0.010, 0.020 and 0.030 inch large, and that the cost to the customer for a piston and set of rings with pin and screws complete for one cylinder is $5.70 for the four-cylinder, and $6 for the six-cylinder style.

This indicates in the most plain and convincing manner the saving in cost that can be made by this method of handling such repairs; and the gain in time is equally as great and acceptable to the car owner. Another advantage that would accrue to the manufacturers of cars would be in being able to advertise the fact that they were in position to furnish repairs at a moderate cost, and their agents could make repairs if needed at the lowest possible cost.

What the Oversize Standards Should Be

It is our experience in regrinding hundreds of cylinders that very few cylinders will clean out with less than 0.010 or 0.012 inch of stock removed. When, however, the scoring is deep and the cylinder shows a great deal of wear 0.025 or 0.030 or even 0.040 inch have sometimes been removed in grinding before a satisfactory surface and hole accurately round and straight can be produced.

It is my impression that two oversize standards would be sufficient in order to reduce the stock that any agent would be obliged to carry, and that 0.015 inch larger for the first oversize standard, and 0.035 or 0.040 inch for the second would really be found ample for all cases and a most satisfactory combination.

The 0.015 increase would be practically 1/64 inch larger than standard, while the 0.040 increase is only 1/25 inch. There is no question but that any cylinder in which the walls are of reasonable thickness will stand this amount of increase; in fact, a great deal more, as this amounts to but 1/50 inch on each side.

Co-operation of Manufacturer and Repair Man Necessary

This whole proposition to be most satisfactory must be mutual; it is of no great advantage for the repair man to install a cylinder grinder for the refinishing of holes and still be obliged to go to the

*Read before convention of Automobile Engineers.

†General manager, Heald Machine Company.

job shop for his pistons and rings; neither are the full advantages secured for the manufacturer to adopt and furnish the oversize pistons and rings unless the cylinders can be readily refinished to oversize dimensions to accommodate these. But the advantages are so obvious and the means of accomplishing them are so easy that it is my earnest hope that this most desirable arrangement be worked out to the mutual advantage of all parties, both financially and in the matter of time, in making engine repairs involving cylinders, pistons and rings.

Standard Test Bars for Cast Iron

At the Copenhagen congress of the International Society for Testing Materials, the so called "Arbitration Test Bar for Cast Iron" was fully discussed, and comparisons made of the practice prevalent in the several interested countries of the world. It will be remembered that the test bar in question is 1¼ inches in diameter, and 14 inches long, being broken transversely on supports 12 inches apart.

The comparison of practice showed that so far as the diameter of the bar is concerned, there is a general accord, foundrymen and users of castings having finally concluded that as large a bar as can conveniently be handled on ordinary testing machines is the one to adopt. Germany, Italy and the United States have adopted the 1¼-inch diameter, or metric dimensions very close to this. England, while quite favorably inclined, has not yet acted officially on the subject.

In the original discussion of the subject in the United States years ago, it was decided to break away from existing practice where necessary, in order that the best results might be had, it being felt that a turning point had been reached making this action necessary. The committee having the matter in hand consisted of the foremost men in the cast-iron industry of the country, and results have amply borne out the wisdom of the conclusions arrived at. Even at that time it was suggested that three sizes of bars be taken, to represent light, medium and heavy castings. This scheme was not adopted at the time, as it was felt to be cumbersome, though offering theoretical and practical advantages. Germany, however, with characteristic thoroughness, adopted the plan for a time, but finally broke away from it, taking the single standard, in this following the American example of getting a bar that would indicate the quality of the metal used, rather than the specific test of the castings as nearly as this could be done without breaking them or cutting out coupons.

Further, the manner of preparing the test bar, seems to be in accord everywhere in its main features. Bars to be cast on end, in dry sand. Germany differs only in pouring from bottom up, whereas all the other countries pour directly into the top. German practice is undoubtedly the better one, though more expensive.

The radical difference in the several standards seems to lie entirely in the length of the bars for test. We break at 12 inches between supports. Germany makes it almost two feet, while Italy takes the distance only six inches. It was therefore suggested at the Copenhagen congress that a series of tests be made in the several countries interested, with bars ranging from six to twenty-four inches between supports in breaking them, and from the results obtained that length be selected which will give the best all-round values.

Walter Wood, of R. D. Wood & Co., the chairman of the commission on cast iron, took up this work for the United States, and reported at the last meeting of the American Society for Testing Materials. A short synopsis of the results is given herewith, in the hope that it might stimulate further investigations along the same line, and thus add to our sum of knowledge.

Results of Tests

Three grades or classes of iron were experimented with. Silicon selected was around 1½, 2 and 2½ per cent., metal being taken in hand ladles from four-ton mixing ladles of the several irons in question. The diameters of the standard bars cast varied from 1.23 inches to 1.25 inches in diameter, and results were properly corrected. Both transverse and tensile tests were made, though it may be mentioned that the modern tendency is entirely against the use of the tensile test for cast iron on account of the inaccuracy of the work that is liable to occur when least expected.

The results were as follows:

Grade	Set	Si	S	P	Mn	C. C.	G. C.	T. C.
A	1	1.65	0.10	0.82	0.45	0.80	2.78	3.58
	2	1.58	0.11	0.79	0.44	1.04	2.70	3.74
	3	1.49	0.11	0.80	0.44	0.86	2.85	3.71
B	4	2.10	0.08	0.81	0.47	0.72	2.82	3.54
	5	1.94	0.07	0.79	0.51	0.70	3.04	3.74
	6	1.88	0.065	0.79	0.44	0.73	2.85	3.58
C	7	2.67	0.08	0.72	0.65	0.75	3.01	3.76
	8	2.45	0.08	0.87	0.41	0.70	0.29	3.60
	9	2.36	0.08	0.86	0.38	0.75	2.81	3.56

ANALYSES OF IRON IN THE TEST BARS

Grade	Set	Lb. per Sq.In.	Remarks
A	1, 2, 3	25,600	Average of 9 bars
B	4, 5, 6	24,370	Average of 9 bars
C	7, 8, 9	24,660	Average of 9 bars

TENSILE TESTS

The above being for 1¼-inch diameter bars, it would indicate an excellent iron for the composition in question.

Modulus of Rupture in Pounds per Sq.In.

Grade	Set	12" Span	18" Span	24" Span	Remarks
A	1, 2, 3	47,100	45,600	44,700	Average of 9 bars
B	4, 5, 6	45,500	43,200	39,700	Average of 9 bars
C	7, 8, 9	45,200	44,900	44,000	Average of 9 bars
Av.	1, 9	45,930	44,750	42,800	Average of 27 bars

TRANSVERSE TESTS

The above would indicate a steady downward progression of the modulus of rupture for cast iron, as the span increases, showing that the test loses in accuracy as a consequence.

In order to get at the subject a little closer, ten sets were cast, each of four bars, 1¼ inches in diameter and 26 inches long. These were broken on supports 14 inches, 16 inches, 18 inches and 20 inches apart. The composition of the metal was as follows:

Silicon, 1.90; sulphur, 0.08; phosphorus, 0.750; manganese, 0.65; combined carbon, 0.55; graphitic carbon, 3.10; total carbon, 3.65.

The average of the transverse tests on these bars gave the following:

Breaking weight in pounds.....	14"	16"	18"	20"
Average of 10 bars.	2,450	2,135	1,900	1,720
Modulus of rupture in Pounds per square inch.....	44,000	43,800	43,800	44,100

From the above little can be judged. The difficulty remaining would seem to lie in the fact that no tests with spans as low as 6 inches are available. With such results, it would be possible to plot a curve showing the relation of the span to the modulus of rupture of the material, the turning point being found when too great a stiffness and consequent high results, change to too great a weakness, or possible lack of sensitiveness on the part of the test, on the other side. This point, when found for the several classes of iron at issue, would be the desirable length of the span for a standard test.

There is need therefore of extending the above series of tests by supplying information with the smaller spans, and thus enable an international agreement on the length of the test bar for arbitration purposes to be finally selected, closing the subject until the time comes when further light on the complicated subject of cast iron may make it desirable to open the matter up again.

*Proceedings of American Foundrymen's Association.

One way to impart a deep blue to polished steel is to place it in sand and heat until the color is obtained. Another way is to paint it with blue lacquer, which is more usual.

Economical Hydrostatic Testing

By Frank S. Bunker

Where a product has to pass a regular hydrostatic pressure test, rapidity of operation and economy of fittings are prime necessities.

A variable pressure accumulator, rapid couplings and special rigs for testing pipe fittings.

An old planer bed for a testing table.

For some classes of work it is necessary that parts to hold pressure should be subjected to hydrostatic tests to discover flaws or other weaknesses before shipment. This is particularly true of pipe fittings, and as rapidity of operation is an essential of economical production, the accompanying illustrations are presented to show some special devices designed for testing this line of product with maximum economy of both time and material.

In Fig. 1 is shown a sectional view of my own design of a testing-room hydraulic-pressure accumulator, which is one of the most important parts of the testing equipment. The object of an accumulator is to maintain a uniform and predetermined water pressure, independent of pump pulsations or variations in quantity of water used. The accumulator consists of a hollow cylinder into which is fitted the ram *B*, from the top of which is suspended a dead weight made up of a number of flat rings arranged to give a large range of water pressures.

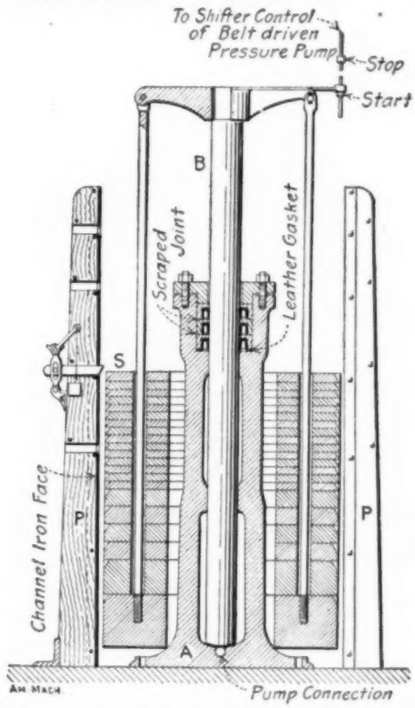


FIG. 1. VARIABLE-PRESSURE ACCUMULATOR

The packing used in this accumulator consists of three inverted U-cup leathers filled with braided flax. Each cup is fitted into a bronze ring whose upper and lower faces have been scraped to a joint with the rings next above and below; the entire set rests upon a leather washer and all are there securely clamped by the gland *C*. At the upper end of the ram *B* a yoke is loosely fitted to rest upon a shoulder turned to receive it. From the extremities of its four arms eye bolts hang, the lower ends of which are threaded into a weight *W*, which is of such proportion to the area of the ram as to give a water pressure of 100 pounds to the square inch. Resting upon this weight are a number of other weights W_I W_{II} W_{III}, etc., of such varying thicknesses as to give the pressures shown on them in Fig. 1. It will be seen that the set consists of one 50-pound, four 25- and fifteen 10-pound sections, making a total of 400 pounds pressure per square inch. The holes through which the bolts pass are 1 inch larger than the bolts themselves to obviate any friction.

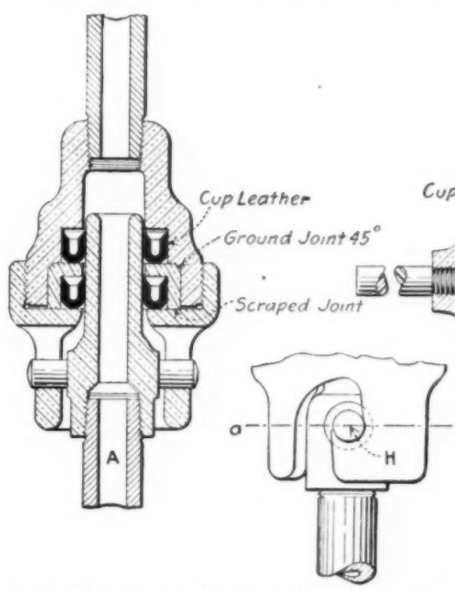


FIG. 2. RAPID COUPLER FOR HYDRAULIC CONNECTION

VARIABLE WATER PRESSURE

Fastened to the same base as the cylinder itself, are four upright posts *P P*, faced with channel iron and fitted with a special set of sliding catches or pawls. The object of these catches is to act as a support to all those rings not needed to make up the necessary pressure for the test in hand. The operation of these catches will be clear from the illustration. The beveled edges allow the catches to act as pawls on the up stroke of the ram, when the catches are slid to the inner position. There are four of these catches to each post, which may be put into or out of operation at will.

To repack this accumulator it is necessary only to raise it about one foot and block up under the bottom weight; release the pressure and the ram drops out of the top yoke, when all worn rings of packing may be taken out with the gland and removed. The system of variable weights by which it is possible to get a wide range of pressures for different tests is particularly recommended for a testing room where such variable pressures are required.

The pressure pump may be of the three-plunger type, preferably belt driven, and by a system of two countershafts with tight and loose pulleys it is possible to put a start and stop rod on the yoke of the accumulator, by which, as long as the belt is running, the accumulator may automatically control it. Then, by throwing the belt on the first countershaft, the second countershaft and pump also may be stopped.

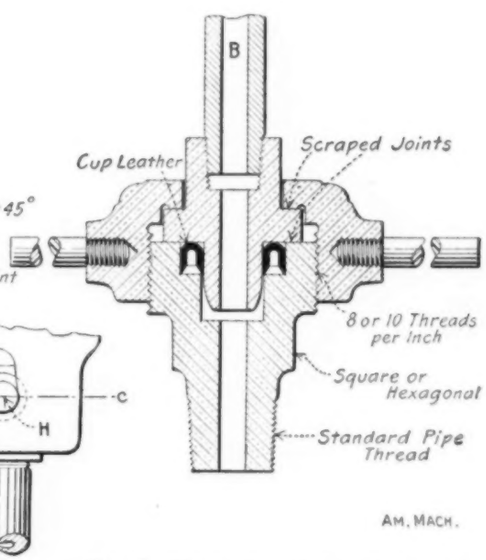


FIG. 3. HYDRAULIC HAND UNION FOR FINAL CONNECTIONS

RAPID-PRESSURE CONNECTIONS

At numerous places around the testing room should be taps leading from the pressure lines. These lines should be so run as to be of easy access and yet be

out of the way. Very few fittings should be used and long bends and sweeps made in the pipes whenever possible. As many outlets or taps as practical should be used to avoid crowding of work.

One of the many expenses of testing is the cutting and threading of nipples and pipes, and the fitting and connecting of these pipes to the piece to be tested. This expense must be eliminated altogether. Fig. 2 shows a sectional view of a rapid coupling for this use, either for high- or low-pressure water, or air. The upper half is connected into the stop valve on the main-line tap, while the lower half is fitted to the pipe *A* of any of the flexible or semiflexible joints, Figs. 4, 5 and 6. Fig. 7 is a swivel joint which should be used in the pipes *A* and *B* of all these flexible joints, which will make them absolutely universal in action. It is a matter of personal opinion which is the best of the three joints, Figs. 4, 5 and 6, as all will do perfect work and are leakless.

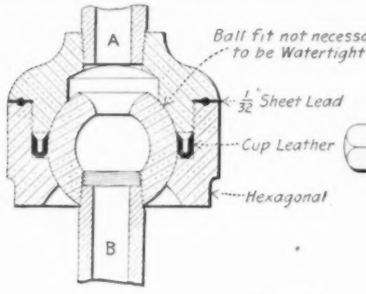


Fig 4

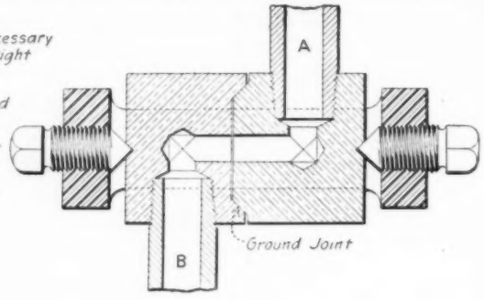


Fig 5

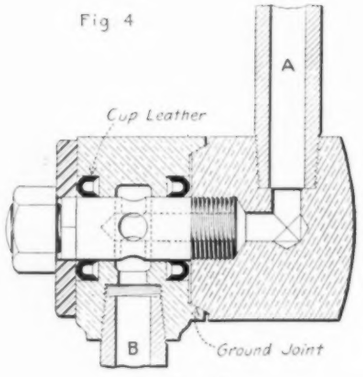


Fig 6

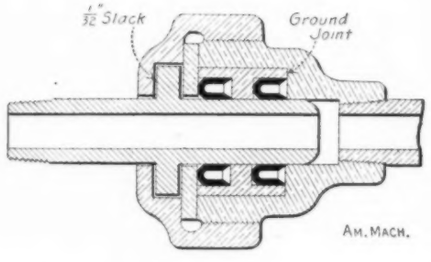


Fig 7

UNIVERSAL HYDRAULIC CONNECTIONS AND A SWIVEL JOINT

WIDE FLEXIBILITY WITH SOLIDITY

With the rapid coupler, Fig. 2, it is necessary only to shove the central pipe into the main housing and give it a quarter turn which sets the cross pin in the hook *H*, thus locking it. While the pressure is on, it is impossible to shove it up and disconnect it.

The connection at the piece to be tested is made with a hand union, Fig. 3. This union has two very distinctive features; viz., the cup leathers instead of a ground joint, and the inserted pins similar to the spokes of a wheel wherewith to tighten and loosen the connection. By having a number of threaded studs (the lower half) made to fit different sized threaded holes; both machine and pipe threads, and the upper threaded end interchangeable with the union nut; a great time saving is effected.

By the proper interspacing of swivels, on the pipe ends of the flexible joints, a rapid-coupler ends and hand-union parts connection of any kind may be made in three minutes to any place within reach of the total length of the connections at hand, and that without cutting or threading a single piece of pipe to be wasted or scrapped later on. Your connecting line will be as flexible as a hose with the strength of a solid pipe line, and a cost of upkeep for cup leathers and oil which is practically nil.

SPECIAL RIGS

It often is necessary to test a large quantity of small parts, such as pipe fittings; elbows, tees, crosses, bends, valve bodies, plug-cock bodies and others, which are to be used in the handling of gases, such as ammonia, carbonic acid, etc. Some special rig is necessary for good and rapid work.

Figs. 8 and 9 show special rigs for testing elbows, tees and crosses. The jaws *A A*, Fig. 8, are designed to fit over the movable and stationary jaws of a machinist's vise and to be clamped there securely by means of set screws. To the center of these jaws are hinged the blocks *B B*, which in turn are hinged together at their opposite ends, thus forming a toggle and working as a toggle when the movable jaw of the vise is traversed in and out.

Plates *D* are recessed to receive semi-vulcanized disks of rubber and are fastened to *B B* by screws. These disks form the seats or joints between the faces of the elbow and the blocks *B B*. A stop *S* can be adjusted to make this joint perfect.

Clamping the elbow in place may be accomplished in a number of ways; the best and quickest is by use of a compressed-air cylinder equipped with a cup leather piston and plunger, as shown. At the outer end of this plunger is a saddle of cast zinc. This saddle fits over quite a large area and then distributes the clamping pressure to prevent denting or injury to the fittings. The coil spring gives the quick action on release of air

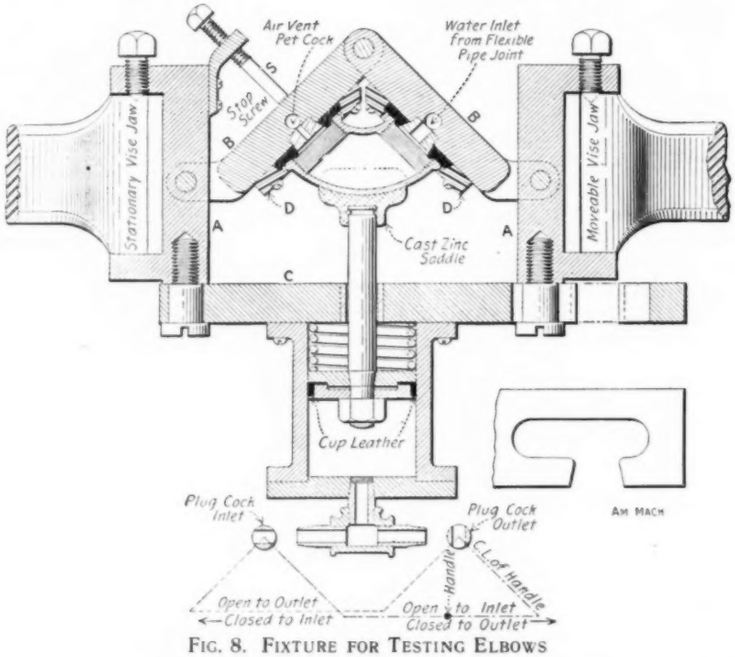


FIG. 8. FIXTURE FOR TESTING ELBOWS

necessary to rapid work. Either a three-way cock, or 2 one-way cocks fitted with levers, connecting links and handle, may be used to operate the inlet and exhaust of the air which is supplied from a hose. The water-pressure inlet is made by use of fittings shown in Figs. 4 and 7.

For tee testing, Fig. 9 is self-explanatory. The same cylinder and plunger are used with a zinc saddle changed to suit the new conditions. For a cross or plug-cock body, or any body having four outlets, the detail to the right of Fig. 9 shows the form of the piece fitted to the plunger to take care of the fourth opening.

All, or nearly all the tests on these fittings are made before any machine work is done on them, it being necessary only to remove burs and fins from the faces to secure a water-tight joint without injury to the rubber disks.

Testing-room Conveniences

A few words about a testing-room convenience will not be amiss. Where heavy, more or less rough castings are being handled rapidly, nothing makes a better operating bench than an old, cast-off planer bed grouted upon a concrete base. Not only is this solid and indestructible, but with its tee-slots and bolt holes already cast in, is most convenient for arranging apparatus. The water-pressure connections may be brought up through this table at suitable points, and if the table is large enough, it may be mounted in the center of the room, with access to all sides, an overhead hand or pneumatic hoist being provided for heavy lifting.

Testing-room floors should have a wooden grating above the concrete floor and ample drainage provided to carry off the spilled water to prevent sickness among the men.

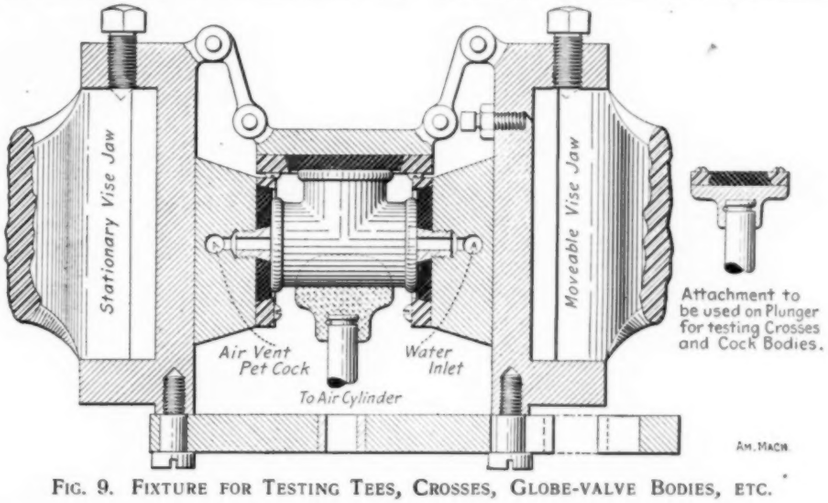

Stationary Vise Jaw
Moveable Vise Jaw
Air Vent Pet Cock
Water Inlet
To Air Cylinder
Attachment to be used on Plunger for testing Crosses and Cock Bodies.
AM. MACH.

Fig. 9. Fixture for Testing Tees, Crosses, Globe-valve Bodies, etc.

Draftsman: (in Court) "What a rasping voice that lawyer has."

Machinist: "That's all right, he is filing charges."

50 Years in the Steam Pump Business

By an Old Timer

With the exception of a small compound relief motion single-double acting pump, placed in Greenwood cemetry to pump water from Sylvan lake to a small reservoir about 100 feet higher up, there had been no attempt to build a water works engine at the old shop, until the latter part of 1853. During the years 1849-50 the great granite drydock was being built at the Brooklyn navy yard by Mr. McAlpine, a distinguished civil engineer. The whole area occupied by the dock was found to be a bed of quicksand flowing up from which, as the excavation deepened, were innumerable springs of fresh water. Every variety of pump was tried to keep the water down, but the fine sharp sand would destroy them so rapidly that it was said at the time, by the on-lookers, that there was a "torchlight procession" of pumps going to, and coming from the navy yard night and day. It was about this time that Mr. Worthington devised the plunger and ring for the special purpose of avoiding the rapid destruction, by sand or grit of the old conventional form of piston and cylinder pumps. He also made it possible to remove the worn plunger and rings in a few minutes, replacing them with new ones, so that there was practically no delay in the service.

The worn rings and plungers were sent to the shop every day and refitted at a trifling expense. He offered the contractors at the navy yard two of his relief-valve motion pumps—size 12x7¼x9 inches, guaranteed to pump a given quantity of water per 24 hours, for any length of time, the contractors to pay for the repairs to the plungers, rings, valves. etc. These were renewed twice a week on each pump, and a new set of 3-inch diameter rubber valves two or three times per month.

The pumps were located on huge pieces of timber 18 or 20 inches square, across the main pump well (where later on the big pumping engine was to be placed) and took steam from an old locomotive boiler, perched on the edge of the bank of the pit.

As fast as the plungers and rings were badly worn they were replaced by new ones in about twenty minutes and the damaged ones sent to shop for repairs, always keeping on hand a new set for each pump.

Three young fellows from the old shop took charge of the pumps, the 24 hours' service being divided into three shifts of eight hours each.

Many a time we had to row from Williamsburgh to the dry dock at midnight, or at four o'clock in the morning, to relieve the man on duty, sometimes through heavy rain and wind and pitchy darkness. We were sometimes challenged by the sentries on the navy yard docks, when the weather was fine and they happened to feel like it, and always by the ones on guard on the old receiving ship "North Carolina."

One night in a terrific thunder storm the bank on the side of the big pump-well pit parted at about twenty feet from the edge, making a crevice about eight inches wide, and the ground settled under the boiler so that the neck of the safety valve broke off and the steam pipe fell into the rubbish below. The boy on duty was at that moment on top of the boiler to find out how things were standing the strain, fell to the ground in close company with the safety-valve ball, and the lantern landing between the boiler and the woodpile. The roaring of the steam, the thunder and lightning, and the torrents of rain made matters pretty lively there for an hour or two, and the cracking and straining of the huge timber braces added to the sense of insecurity in the darkness; but by noon next day things were made shipshape and in a few hours the water in the big well was pumped down again.

Observation vs. Solid Stops

There is a growing feeling that solid stops are not as reliable as we formerly supposed. All metal has its yielding point and, as the pressure exerted by the operator varies according to the state of his emotions as well as in direct ratio to the elapsed time since his last meal, the results are not uniform.

So we find an increasing use of what Bullard calls "observation stops," being applied to all sorts of machines, usually by the users, instead of the builders. This is being done on many classes of machines by the use of large, graduated dials and more uniformly accurate results are claimed than with the solid-stop method.

Employer, Employee and Inventions*

By H. Parker Smith

The rights of both where the invention is made by the employee alone, and where both employer and employee collaborate in producing a patentable invention. In the first case the underlying principle is: In the absence of contract the employer has no title to the patent right on anything invented by an employee. In the second case the question is much more complicated.

*Condensed from a paper presented to the American Society of Mechanical Engineers.

The broad question presents two phases:

First, as to title to and rights under inventions made by the employee alone.

Second, as to inventorship in cases where employer and employee collaborate to a greater or less extent in producing a patentable invention.

On the first point the principles involved are simple, though there is sometimes difficulty in applying them in a given case.

The basic, underlying proposition is that, in the absence of a contract, express or implied, the employer has no title to the patent right on anything invented by an employee.

If there is an express contract either in writing or clearly provable by oral testimony, the matter is simple, if the terms of the contract are clear, and, of course, the respective rights of the parties are as defined in the contract.

Such a simple case arises where an employer specifically employs one or more experimenters or investigators to invent and discover machinery or processes to perfect an old manufacture or develop a new one, and expressly stipulates that the patents on all inventions produced shall belong to the employer and shall be obtained at the employer's expense. If, then, the employee refuses to execute any such application properly prepared or to assign same to the employer recourse may be had to a court of equity to enforce specific performance of the contract.

Many large corporations have bureaus for this work of inventing under contract. An elaborate department of this kind is maintained by the General Electric Company, at Schenectady.

Another case is where large employers of skilled labor make it a rule to have every officer and employee sign a brief contract by which he agrees, in consideration of his employment and of a portion of the wages or salary paid him, to assign to the employer all patents which may be taken out on inventions, connected with the business, which the employee may make during his employment. In ninety-nine out of a hundred cases, occasion never arises to enforce the contract, but it clears the atmosphere and removes possible disputes where patentable inventions are produced.

Where no contract is clearly expressed in writing or in an oral agreement, and the employer's right to the patent is sought to be established under a contract implied from the circumstances, acts of the parties, admissions against interest, etc., there is opportunity for protracted litigation of doubtful outcome.

In the absence of a contract express or implied as above, the employer has no right to patents obtainable on inventions made by the employee, no mortgage on that particular byproduct of his brains.

Of course, the employer has the title to the corporeal thing or things produced by the employee in the employer's time and with the employer's materials, and also a shop right to continue its use as long as it lasts or can be maintained by reasonable repairs, but in the simple case of employment with incidental invention by the employee, the employer has no right to manufacture other specimens of the invention and use them, without the patentee's license, if the employee patents the invention, and the employer has no right to compel an assignment of such patent to himself.

If the employee invents a process for carrying on work of the employer while working in the employer's time and at his expense, the latter has a shop right to carry on that process.

Situations That May Arise

The situations which may arise may be generally grouped as follows:

First, employment for usual services with no reference to inventing or making improvements, in which case the employer has no right to patents taken out on employee's inventions, and no license to use anything but the specific thing made in the employer's time and with his materials. If the invention is a process, the cases seem to hold that the employer would have a shop right to use the process as long as he remained in business.

Second, employment with a contract specifically providing that the employer shall have title to the patents, and

Third, employment with an understanding that the employee shall devote himself to the inventing and discovering of new machines and processes for the benefit of the employer, but without specific provision that the patents on such improvements shall belong to the employer.

In the last case the courts have generally held that the patents belong to the inventor-employee, but that the employer has a license to manufacture, use and sell the patented things as long as he remains in business, such license not passing to the successors or assign of the business, unless the patentee tacitly consents to such transfer of the license, as by continuing his employment with the successor or assignee, and making no objection to the continued use of his inventions.

Even if one is employed specifically to devise improvements, the employer is not entitled to the patents, unless there is a contract to assign.

There is an old case which holds that the rule is different where one is employed by an inventor and under his directions. There the presumption is that any improvement made is the invention of the employer.

Among the leading cases on this question of license may be cited the following:

Where one, generally employed as an engineer or as a superintendent, makes an invention and builds a structure embodying that invention in the employer's time and at the employer's expense, the employer has a license to use that specific machine and no more.

Where one is specifically employed to improve processes and machinery employed in manufacturing, the employer has a perpetual license to use the processes invented, and the number of machines actually built.

Where an employer is engaged in the business of making and selling machines, and one is employed to improve these machines, there is an implied license to the employer to continue making and selling such improved machines.

Such presumption of license is strengthened where the patentee explicitly or tacitly assents, during a considable period, to the continued use of his invention in the manufacture of machines

In the last case the court stated the theory of the law as follows:

"When a person in the employ of another, in a certain line of work, devises an improved method or instrument for doing that work, and uses the property of his employer and the services of other

employees to develop and put in practicable form his invention, and explicity assents to the use by the employer of such invention, a jury or a court, trying the facts, is warranted in finding that he has so far recognized the obligations of service flowing from his employment and the benefits resulting from his use of the property, as to have given to such employer an irrevocable license to use such invention."

Another case in which it has been held that the patent belonged to the employee who invented while investigating at the request and expense of the employer—in the absence of a contract to assign to the employer.

When the employer pays the expense of patent application, presumably he could recover same from patentee employee, unless the payment he considered on account of license.

Of course, there are certain practical difficulties in enforcing all of these legal rights and certain abuses practised in spite of them.

It is a simple matter for an employee bound by a written contract to assign all inventions to his employer, who conceives a valuable invention in the line of his work to keep it secret until he has resigned, or his contract terminated and then patent it himself and maintain that he did not conceive it until after his contract of employment was terminated.

It is also possible for an inventor under such contract to confide his ideas to confidants who are not under contract and who are willing to swear that *they* made the inventions. The latter can then usually obtain patents and quietly share the profits with the source of the inspiration.

There is a case where the wife of an inventor, who was a party to a contract of this kind, patented certain inventions in the line of work covered by her husband's contract and, in litigation which resulted from the situation, developed a most woeful ignorance of the simplest details of the somewhat intricate electrical specialty in which she had presented herself to the Patent Office as the inventor; the sworn specification discussing in detail the problems involved.

There are also cases where the boot is on the other leg, where employers and managers of corporations boldly take out patents in their own names for every patentable improvement their employees develop, and carry the thing through by sheer force of superior position and power.

The foregoing discussion relates to inventions which are clearly the conception of the employee and developed by him, and deals with the question as to who has the legal or equitable title to the patent which can confessedly be properly granted only to the inventor, who is the employee.

Situation When One Employs Another to Perfect an Invention

Under the second heading we deal with the more complicated question presented where one having an idea, or maintaining that he has one, employs another to put it into workable form, or to perfect the details.

A valid patent can only be granted to the first and original inventor. Who is the inventor in cases of this kind?

Roughly speaking there are three classes of cases.

First, the class in which a person, usually not skilled in the particular art concerned, goes to one who *is*, and says:

"I want to get up a machine, or process to do so and so."

The person so commissioned works out something to accomplish the result and fit the conditions prescribed by the employer.

In such case the machine or thing invented belongs to the employer as before, but the right to a patent and the consequent monopoly of reproduction belongs *to the employee*. It is his invention and in the absence of a contract to assign the patents to the employer, the facts fall in with the last line of cases above discussed.

Second, there is the class in which a person not only has a clear idea of the *result* to be accomplished and the conditions to be fulfilled, but also has a general idea of the novel *means* which he wishes to employ for the purpose and instructs or commissions another more skilled in the art to work out the details.

If some ingenious purchaser of the earliest form of steam engine had said to Watt:

"I want an engine which shall be automatic in its operation; I think you can connect the mechanism for opening and closing the inlet and exhaust valves to some of the moving parts of the engine and so make the engine itself open and close the valves, so that we can save the wages of the boy who now works the valves, and have the work done better."

And Watt had put that idea into practical shape, the broad patent on such pioneer automatic fluid-pressure engine could only have been taken out in the name of the ingenious purchaser, because *he* had the novel idea of means broadly, and Watt could have been merely the skilled mechanic who worked out the details.

In the same way if it really was a lazy boy employed to operate the valves by hand, who first tied the valve levers to the walking beam of the engine, and so produced an automatic primemover which would run on while he played marbles, then that youthful and lazy genius was the true inventor of that feature of the modern steam engine and a valid patent covering the embodiment of that principle could only have been issued to him.

The Supreme Court has phrased the law thus:

"Where an employer has conceived the plan of an invention, and is engaged in experiments to perfect it, no suggestions from an employee not amounting to a new method or arrangement, in itself a complete invention, are sufficient to deprive him of the exclusive property in the perfected improvement."

The Court of Appeals for the District of Columbia, said:

"Where one employs another to make a device; pointing out the distinct and dominating feature of his improvement, but does not make anything resembling a perfect drawing for the guidance of the other, or describe the proposed construction in detail, the maker of the device is not entitled to claim the invention, through by reason of his mechanical skill he may have made a neater and more perfect device than was in the mind of his employer."

It has also been held that where the skilled employee has been at work perfecting an invention of his employer, and a patentable improvement is made on the original device, the inventorship of which is in dispute, the presumption is in favor of the employer.

The first and second classes of cases above defined represent the extremes. The third case lies between, where the employer has the idea as to *what* he wants accomplished, and some idea as to *how* it is to be accomplished, but the same is not completely practicable until supplemented by suggestions of the employee which involve more than mere mechanical skill and which either greatly improve the operation of the device, or actually bridge over a gap existing between the employer's suggestion and final success. In such case a valid patent on the complete thing can only be granted to them as joint inventors.

Of course, if the employer's suggestions as to means prove impracticable and do not teach anything toward the accomplishment of the desired result, but have to be abandoned, and success is reached along another line worked out by the employee, then the case falls within the first class above defined under this general head. The employee's contribution then amounts "to a *new* method or arrangement, *in itself a complete invention*," to quote the language of a court discussion.

The "Practical Operation of Arc Lamps" is the title of an interesting little book recently issued by the National Carbon Company, Cleveland, Ohio, presumably for general distribution. It contains about 70 pages of information concerning arc lamps of various kinds, the way they should be located and handled, the carbons to be used and much other general information which will be of value to the man who looks after the electric equipment of any shop.

Novel Method of Machining Connecting Rods

By L. H. Morgan-Browne.

The following is an account of how I machined the forks of four connecting rods, for the engines of two 18x38x72 inches stroke, compound stern-wheel engines, in a small shop in Hong Kong.

First I ought to explain that the parties who let the contract to the firm I was with, furnished the tracings, and prints of these were sent to my firm's agents in England for them to order the forgings for piston and connecting rods.

In due course, the rods arrived, with the fork forged solid.

"How are you going to machine those?" said the manager to me. We had no boring machine and no slotting machine and the shaper was inaccessible to a rod sixteen feet long.

"Well," I said, "I can't tell you at once, but I'll rig up something." And this is what I rigged up. I took the gap from a large old-fashioned faceplate lathe to use as a bedplate. It was about five feet long with the slots running lengthwise for driving gear. I was fortunate in finding a discarded worm gear, reduction worm wheel and housing, complete, as shown in illustration. Loose pulleys were secured to the worm shaft and the driving gear was complete.

The boring bar I made from a piece of 2-inch shafting, one end of which I turned down and keyseated to suit the bore and feather in the worm wheel; in the end of the reduced part I drilled and tapped a hole, into which I screwed a ¾-inch rod on which a fine thread had been cut. This screw rod was furnished with a plate nut and the plate with two studs to attach it to the housing, into the upper and lower halves of which two holes were tapped to take them; this completed the feed mechanism.

The whole was assembled as follows: The housing was bolted down to the bedplate, which was leveled up on the floor of the shop. A hole was dug for the pulleys and the outer end of the pulley shaft was carried in a box bolted to a plank chained and weighted to hold it in place, and the boring bar was carried in five 2-inch ordinary shafting boxes.

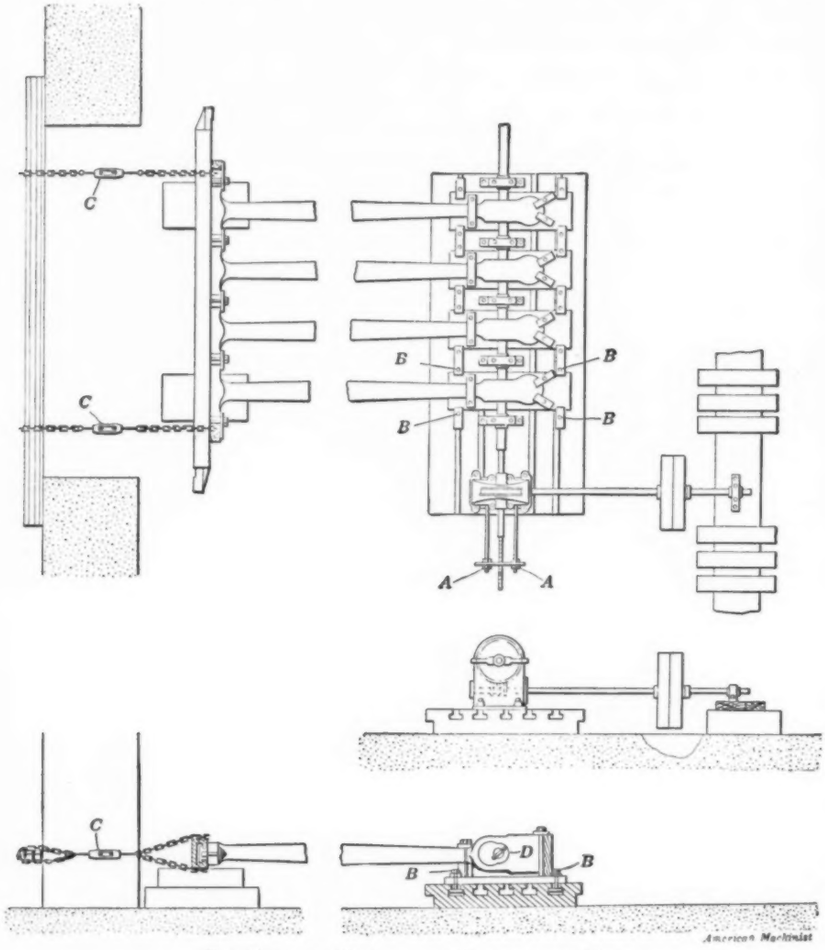
The rods, after having a 2⅛-inch hole drilled through them for the bar to pass through were set as follows: One between each pair of boxes was shimmed up and strapped to a long narrow cast-iron plate with tee-slots (four of which we had on hand).

These plates in turn were strapped to the bedplate. The tee ends of the rods were bolted to a cast-iron bar about seven feet long with a tee-slot its entire length (it was one of the crosshead guide bars that was made for and ultimately went into the job). This bar rested on two short cast-iron plates. Round the end of the long bar two chains were passed attached to two turnbuckles, the other ends of which were chained on two lengths of railroad iron placed back to back, and the ends of this girder, so formed, were supported by the brick walls of an archway in the wall of the shop.

The method of operating was as follows: After a cut had been taken, the two outer nuts on the feed-screw studs were taken off, the bar pulled back and the feed-screw plate run up by hand, then shoved back on the studs again and another cut taken, and so on until the hole was the required diameter. Then the tools were set back about 1/32 inch, the bolts *B*, holding the four small plates to the bed, were slacked up and all four rods were drawn back about 3/32 inch by turning the turn buckles *C;* the bolts *B* holding the small plates to the bed were tightened and a cut put through, the tool only cutting on one side *D*, and gradually elongating the hole till the fork was cut right out but 1/16 inch small. Then 1/32 inch was faced off each side with a cutter.

After the crosshead-pin holes had been bored with the same rigging, the crankpin boxes were also bored; but these we did two at a time, as the bed would not take four, and after that the crossheads, which were forged solid with the rods.

The work turned out with this rig, which I devised, but which was operated by two Chinese lathe hands, was first rate, and the time we made I believe was as good as would have been made by ordinary methods machining one at a time.



Rig Used in Machining Connecting Rods

In a paper presented to the American Society of Naval Engineers dealing with the Metallurgy and Heat Treatment of Iron and Steel the following points about iron castings are noted: Strength increases with increase of silicon up to 3 per cent. Silicon decreases the combined carbon and thus prevents brittleness and increases strength. Foundry experience seems to show that the lower the silicon the weaker the small castings and the stronger the large castings; and the higher the silicon, up to 3 per cent., the stronger the small castings and the weaker the large ones. Consequently, with large castings it is usual to use the least silicon that will give the requisite degree of softness.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room. A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Attachment for Boring Jig Plates for the Driller or the Miller

The jig plate having been accurately laid out, a drill is put through with all possible accuracy in reference to the hole circles and master lines; but about 1/32 inch less than the finished size. It is at this stage that the utility of the attachment will be found of considerable service; for without disturbing the job on the driller table, the operator may attach the appliance to his drill spindle and finish the drilled holes by boring, dead true to the lines.

Various designs for the same purpose have appeared in the technical press of late, but I believe that the attachment herewith illustrated and described is simpler and cheaper.

Referring to the illustration, it will be seen that the principle of the eccentric bush has been used for the purpose of compelling the boring cutter to travel in a circular path of varying and easily controllable diameters, the full radius of eccentricity of the appliance shown, being ½ inch.

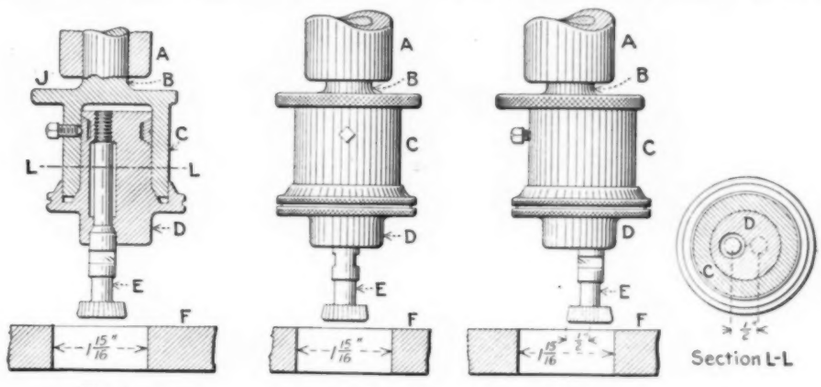


Fig. 1 Fig. 2 Fig. 3 Fig. 4

ATTACHMENT FOR BORING JIG PLATES

Fig. 1 represents the apparatus fixed to the drill spindle *A* by means of the Morse taper shank shown at *B*, to which is attached the main body of the attachment *C*. *D* is the combined eccentric bush and holder for the boring tool *E*. *F* is the jig plate which requires a 2-inch finished hole. The tool is a boring tool simply, and not a milling cutter, and has its cutting edges extending all round, but only one tooth or edge operates at a time. The purpose of the continuity of the cutting points, is to insure that one of the cutting points is always presented to the part of the hole in the jig plate which requires to be machined, and it will be noted that, with an ordinary boring tool, working in conjunction with the rotating eccentric bush, there would be a difficulty in using the attachment.

In Fig. 1, the 1-inch cutter is shown concentric with the center line of the machine. It will just operate, as it is, in a 1 1/32-inch drilled hole.

By turning the holder *D* round 180 degrees, i.e., to the fullest eccentricity (which is ½-inch) a 2-inch hole may be finished thereby.

Fig. 2 represents the apparatus, in elevation rotated 90 degrees from the position shown in Fig. 1.

Fig. 3 illustrates the attachment with the eccentric bush and tool holder, turned to the fullest limit of eccentricity, i.e., 180 degrees, from Fig. 1, in position to finish a 2-inch hole in the jig plate *F*.

Fig. 4 represents a section through *L L* of Fig. 1, showing the round center of the drill which is a ½-inch dotted circle, with the position of the cutters as in Fig. 3.

The cutters may be of any size, and the apparatus may be made with any eccentricity.

The eccentric bush and tool holder is held up to its seat by the steel screw, with pointed rod, pressing on the taper hard, steel collar, which is a working fit in the body of the tool holder. The hole is so located that it provides a means whereby the screw pushes the holder bush upward, giving a firm and substantial seating on the taper at the mouth of the body *C*.

The cutters are simply made, having threaded ends and a pair of flats so that they may be put in or taken out with a wrench. All parts are of mild steel, case-hardened throughout and ground to a finish.

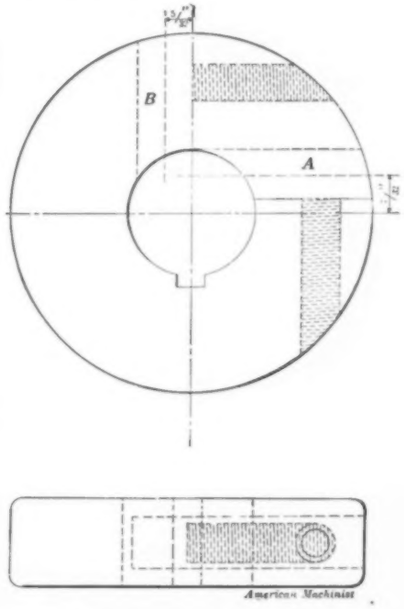
J. T. TOWLSON.

Silverton, London, England.

Holder for Fly Cutters

Having no fly-cutter holder, to be used in milling single-point Whitworth thread tools, and no backing-off attachment for lathe, we made the holder shown in the illustration.

The square hole *A*, which in this case is 5/16x5/16 inch, is set 1/16 inch off center; by turning the required form of cutters in lathe, using hole *A*, and then shifting to hole *B*, when milling, we get approximately 1/64 inch clearance in width of tool, which is ample in most cases. There is a slight error in shape of cutter with this method, but it is so small, it can be generally overlooked.



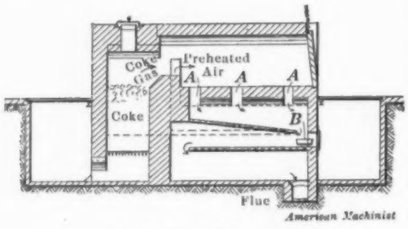
HOLDER FOR FLY CUTTERS

Reading, Penn. A. DANE.

Coke Gas Furnace

This furnace has been found to be exceedingly useful for different manufacturing operations. The fuel cost is very low and a temperature of 2000 degrees is easily attained without the use of compressed air or similar costly appliances.

The coke gas comes in touch with the preheated air at the entrance of the furnace room and heats up the furnace. The products of combustion escape



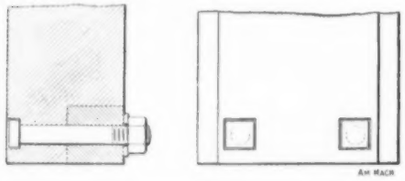
COKE GAS FURNACE

through the furnace floor at *A* in the direction of the arrows. When the furnace is thoroughly heated, the air supply to the gas generator is shut off. The radiation from the walls and the preheated air is then sufficient for many purposes.

Detroit, Mich. W. STOY.

Securing the Cap to the Slide of a Punch Press

A faulty point in detail design is pointed out by a correspondent in the AMERICAN MACHINIST, on page 1215, Volume 33, Part 2, namely, the usual method of attaching the cap to the slide of a punch press. The accompanying line cut shows a successful method adopted some time ago and now used exclusively by a large firm of power-press builders on this side of the water.



METHOD OF SECURING CAP TO SLIDE OF A PUNCH PRESS

In construction, two fitted bolts with square heads are made a light drive fit for the reamed holes and secure the cap in position by means of plain washers and hexagon nuts. The back of the slide is cored out to receive the two bolt heads, which prevents any tendency of the bolts to turn round while adjusting or removing the nuts, and also avoids the necessity of counterboring the slide as mentioned in the previous article. By using fitted bolts with a washer and a single nut on each bolt, it is possible to make use of a shorter set screw for fixing and locating the punch or top die; it also provides better access to the set screws for an ordinary wrench.

I have never known a cap to give any trouble when secured in this manner, and the bolts are simple and easy to replace when the threads become worn.

With regard to tapping studs into the slide, this is certainly much better practice than securing the cap with hexagon head screws and for small machines answers fairly well; but on the larger type of power presses these studs have a knack of coming unscrewed during operation, owing to the excessive vibration set up by punching heavy stock at a rapid rate, whereas, two turned and properly fitted bolts with a washer and hexagon nut on each will hold the cap and consequently the punch or top die tight under the most severe test.

Glasgow, Scotland. O. SAIRLIAN.

Milling Fixture for Nuts

Having to mill 50 nuts and not having a very substantial index head, we devised the fixture shown in Fig. 2, which consists of two hexagon studs, milled on the bottom, as an index for the nut, and a special jaw for the miller vise which was made to locate the studs centrally and to hold them in position. The studs were milled off at the corners, as shown in Fig. 3, to allow the vise jaw

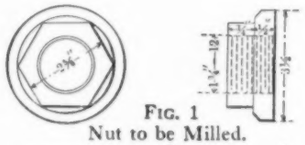


FIG. 1
Nut to be Milled.

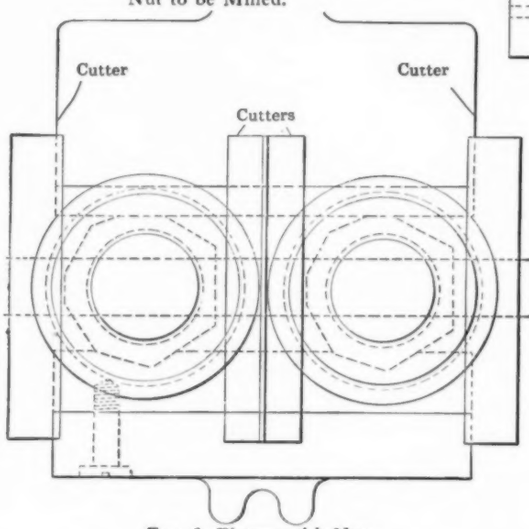


FIG. 2. Fixture with Nut.

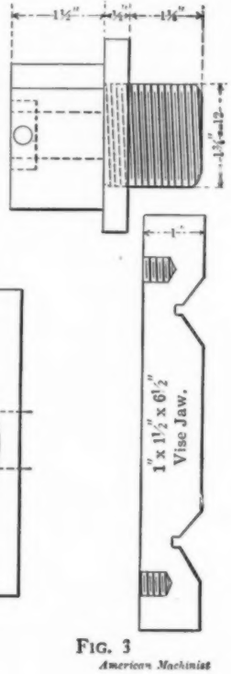


FIG. 3
American Machinist

MILLING FIXTURE FOR NUTS

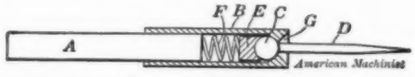
a good bearing, and as they were only turned three times, for the indexing, they did not interfere in any way. The studs were put in place and the nuts screwed on with a pipe wrench, then placed in position and the four cutters set as per Fig. 2. I found the fixture so rigid that I was able to use a very coarse feed.

This is about as good a milling fixture as I have seen for this class of work, but it can be improved upon by boring a hole through the hexagon instead of having the threaded part solid with it. This will allow using different length studs, and by putting in a "dutchman" to keep the stud from turning around, as shown by dotted lines in Fig. 3, it can be used for many different jobs.

Fitchburg, Mass. STERLING.

Tool for Locating Center of Spindle

The accompanying line cut shows a small and cheap tool which I have found almost indispensable. I have been in a



TOOL FOR LOCATING CENTER OF SPINDLE

great many shops in both the East and West, but have never found it in use in any of them, nor have I found anyone that had used it before I introduced it, though I suppose there are a great many mechanics who know of it. The tool is simply a piece of round stock *A*, which forms a shank *B* and is bored out to fit

a good bearing, and as they were only turned three times, for the indexing, they did not interfere in any way. The studs were put in place and the nuts screwed on with a pipe wrench, then placed in position and the four cutters set as per tight on *A* with a socket at the end, which fits the ball *C*.

The ball *C* has a hole drilled through its center and a piece of drill rod about two inches long riveted into it and painted at one end. The ball *C* is held up

against the socket in the end of sleeve *B* by a block *E* and spring *F*. The end of sleeve *B* is countersunk, as shown in the end at *G*. It is used by holding the shank *A* in the chuck of the driller or miller, and by letting the spindle of machine revolve. By holding something against the point *D*, it can be made to run absolutely true, thus showing the center of spindle, so that it can be lined up to a mark or punch mark for drilling or milling.

Syracuse, N. Y. F. O. THOMAS.

Ball Turning Tools

Several ball-turning tools have been described in the AMERICAN MACHINIST, but all have been fastened to the tool post and could be used only when the work was rotating. There are cases when the work has such a shape that it can not rotate in an ordinary lathe. In such cases the work must be stationary, while the tool follows the spindle.

Fig. 3 shows an instance of this sort. The arm extending from the ball is too long to swing in an ordinary lathe, and the shape of it does not allow much room for the tool as the space between the ball and the inner circle is very narrow. We had a large number of these balls to be turned, and had to design a tool for the purpose.

I made a tool shown in Fig. 1, which proved to be very satisfactory. It is fastened to the nose of the spindle by the internal threads. The cut is 1/16 inch, which is divided on a roughing, medium and a finishing cutter, which are shown in Fig. 2. These cutters slide in slots at *A*. At *B* is a feeding handwheel.

While the spindle is turning the operator lays his hand on the top of the wheel and stops it from following the spindle, thus giving it a forward motion, as the threads are left hand. This pushes up the longer end of the lever *C*, while the shorter end presses the cutter down to the work. At *D* is a setscrew and nut for adjustment. When the cutter is down as far as it should go, the setscrew leaves the cone and slips upon the cylindrical part of the handwheel, thus making it impossible to take too deep a cut.

The lever for roughing cutter is about 1/32 inch longer than the one for the medium, which is 1/32 inch longer than the one for the finishing. This allows the roughing cutter to start and stop ahead of the medium, which starts and stops ahead of the finishing. When all setscrews have left the cone, the operator knows that the job is done. Each of the cutters acts as a guide for the work, preventing it from bending same. When the handwheel is screwed back, the spring *E* pushes the cutter back to let the work out.

Fig. 4 shows a simple way of holding the work. It consists of a casting with a hollow, roughly the shape of the work, but much larger. A piece of the work is laid in position in the hollow, and the empty space around it is filled with molten babbitt, thus making a hollow exactly the shape of the work. Two straps *A* and *B* hold the work steady. The fixture is located on the tool post by the tongue *C* and fastened by bolts through the holes *D*.

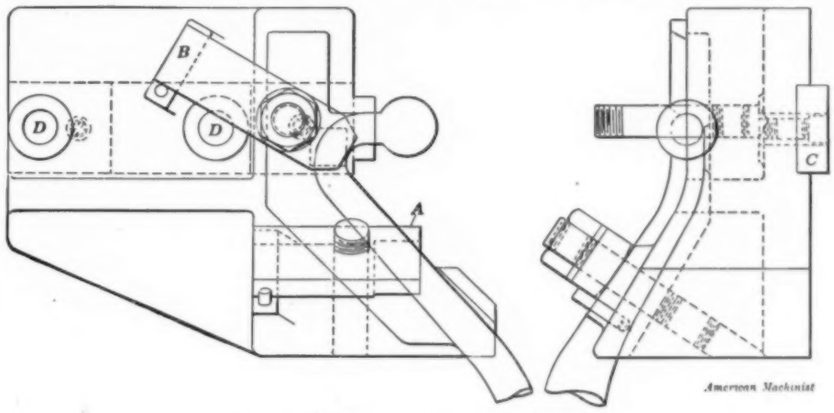


FIG. 4. METHOD OF HOLDING WORK

V. SUNDSTROM.

Sharon, Penn.

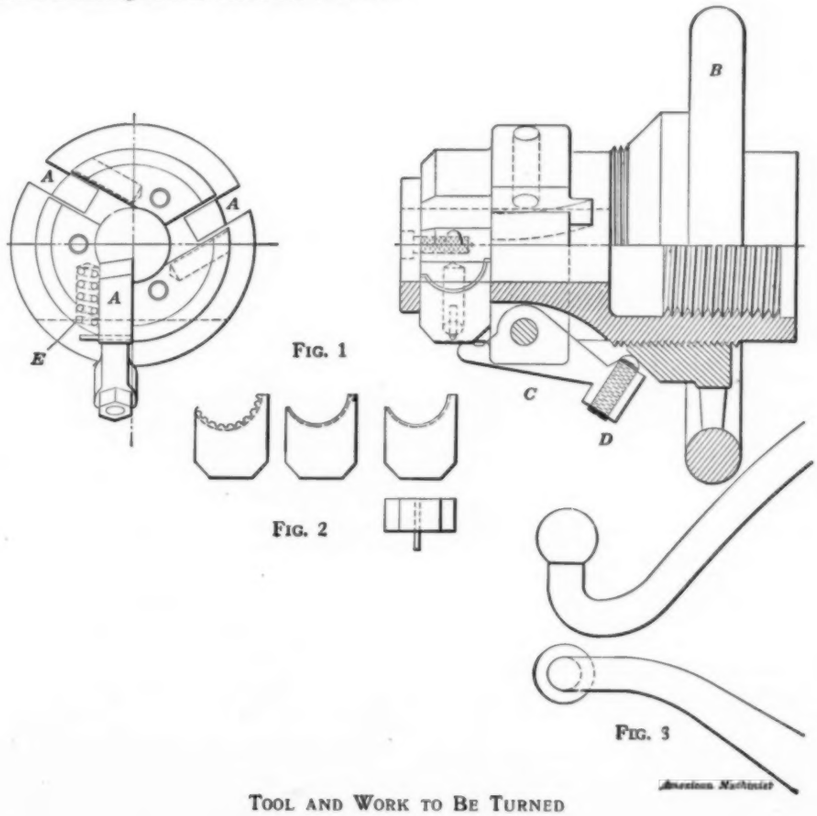


FIG. 1

FIG. 2

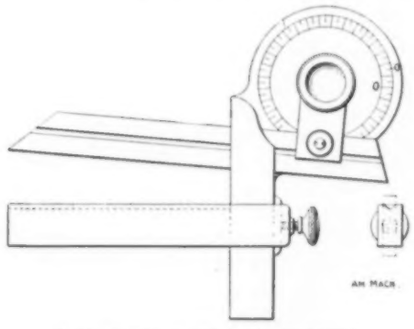
FIG. 3

TOOL AND WORK TO BE TURNED

Attachment for Protractor

I came upon a tool the other day, in the possession of one of the Remington Ammunition and Arms Company's foremen, that looked good to me.

Mr. Wakelee, the owner, told me that he had made it about 19 years ago and at that time used it principally for getting the angle on cutter shanks, for that purpose using the grooved edge. Other uses will be apparent at a glance.



ATTACHMENT FOR PROTRACTOR

This makes a very rigid arrangement and is more satisfactory than many im-

provised tools of this nature that are often seen.

Ilion, N. Y. A. L. LOWE.

Self Centering Chuck

The illustration shows a self-centering chuck for grinding the bore of spur gears true with the pitch diameter.

I have found this chuck invaluable in grinding the bore of gears in quantities.

The body is a piece of machinery steel bored and threaded to fit the spindle of a universal grinder. This is shown in Fig. 1. The back of this body is turned down to reduce the weight and also add to the appearance of the chuck as shown at *E* in Fig. 1. The outside diameter is turned to a taper of about 1½ inches to the foot, about half the distance back; *A* Fig. 1. The remaining half of the outside diameter is threaded to any convenient pitch as at *D*, Fig. 1. This is to take the jam nut, Fig. 6.

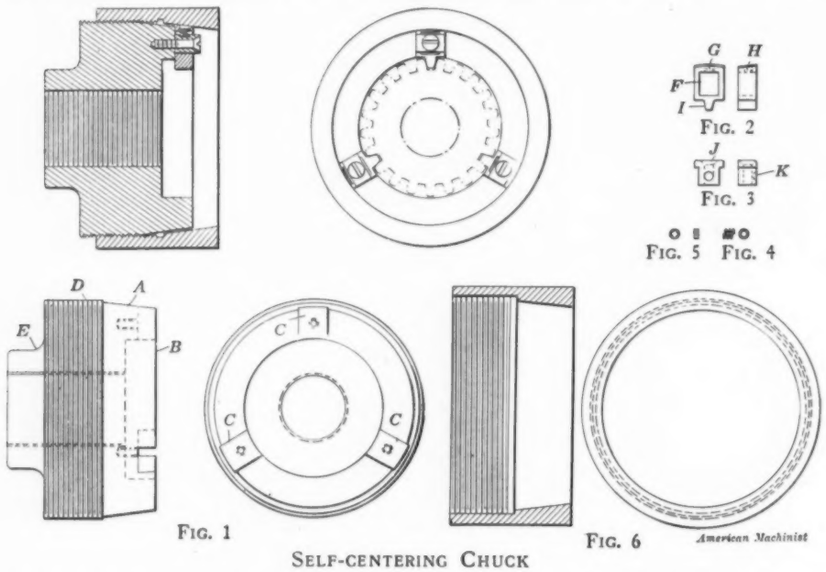


FIG. 1 FIG. 2 FIG. 3 FIG. 5 FIG. 4 FIG. 6

American Machinist

SELF-CENTERING CHUCK

The face of the chuck is counterbored large enough for the grinding wheel to run all the way through the work. The face *B*, Fig. 1, is slotted radially to accommodate the jaws, Fig. 2, which hold the work. The number of these slots is determined by the number of teeth in the gear. It is frequently found necessary to arrange these slots so that one of the jaws straddles a tooth in the gear, instead of meshing between two teeth, as shown in the assembly. In the center of these slots holes are drilled and tapped. These holes are for the flat-head machine screws which hold the guides, Fig. 3, in place. These slots are shown at *C*, Fig. 1. The face *B* and outside diameter and slots *C* are case-hardened and ground true. The jaws, Fig. 2, are tool steel machined to a sliding fit in slots *C*, Fig. 1. These have square holes *F* to take guide, Fig. 3.

Drill and tap a hole *G* in jaws for headless screw, Fig. 5. Turn face *H*, Fig. 2, to the same taper and diameter as chuck body at *A*, Fig. 1.

A tooth *I* is cut on this jaw of the exact pitch and shape of teeth in the gear. These jaws are hardened and ground. The guides, Fig. 3, which guide the jaws, Fig. 2, are tool steel, hardened and ground, with hole *J* drilled for flat-head machine screws to hold them in place, and holes *K* drilled to support spring, Fig. 4. This spring is held in place by screw, Fig. 5. The guides have a shoulder to prevent the jaws from falling out. The springs which rest against the guides, which are stationary, and against the jaws, which are free to slide, have the tendency to push the jaws away from the work. The jam nut, Fig. 6, is machinery steel. One-half of the length is bored and threaded to fit body, Fig. 1, at *D*. The remaining distance is bored the same taper as the body is turned at *A*. Around the outside of this jam nut several holes are drilled for a spanner wrench. This jam nut is case-hardened and ground.

For chucking a gear in this chuck simply unscrew jam nut 6 from body 1 until work slides between the jaws 2; these being pushed outward by springs 4. By screwing up on jam nut 6 the jaws slide up the tapered bore, thus forcing them against the work, and gripping it tight. Since the teeth in the jaws are identical with the teeth in the gear, they only bear at the pitch diameter and the jaws, moving in the same jam nut to the center, the bore must necessarily grind true with the pitch circle.

Gardenville, Md. E. G. FORTHUBER.

Malleable Iron Pot for Annealing High Speed Steel

The line cut shows the cross-sections of a malleable-iron pot for annealing high-speed steel, and also for pack hardening small parts made of machinery or open-hearth steel.

This pot has given satisfaction after considerable experimenting to find one of simple design that would furnish first-class results.

We use two sizes, 8 inches diameter, 10 inches high, and 12 inches diameter, 14 inches high.

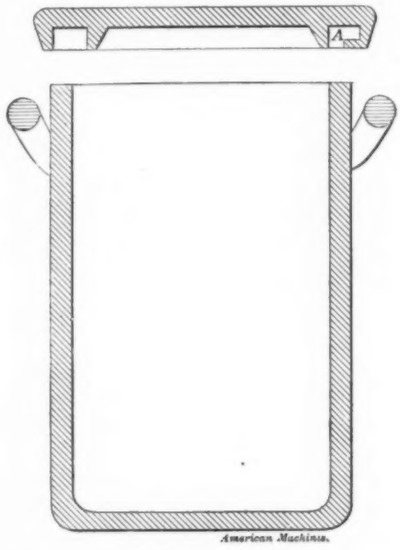
The walls are ⅜ inch thick, the handles are bent to shape out of ½-inch diameter iron rod and placed in the mold.

The groove *A* in cover, which is ½ inch wide, is filled with fire-clay cement, mixed to about the consistency of putty, and then pressed down over pot; this has been found to make an almost air-tight joint, excluding the air for annealing and retaining the gases when used for pack hardening.

Several methods are in use for annealing the various high-speed steels on the market, some are good and some are not; many being very complex.

The following one, though simple, has given the best results of several tried.

Novo-steel cutters of various sizes, averaging about ½x1½x2 inches are placed in circles, one tier on top of another, with a thin quantity of air-slacked lime between them, in the pots before described. The furnace is started about 7:30 a.m. and allowed to heat to 1700 degrees Fahrenheit, which takes till about 10 o'clock. The gas is then shut off and allowed to stand until 3 p.m., when it is again started and raised to a temperature of 1900 degrees Fahrenheit. At 5:30 p.m., the gas is shut off again and the pots left to stand over night; and dumped at noon next day.



American Machinist

MALLEABLE-IRON POT FOR ANNEALING STEEL

This method makes a considerable saving in fuel and also gives steel that can be readily worked up.

Reading, Penn. A. DANE.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Anti-Tipping Pulley T-Square

On page 501, R. A. Rudolph overcomes a defect common on most pulley-type drawing boards in a rather primitive manner, and will find after a little experience with his method that it is in the way rather than useful. This is because the tacks he uses, in spite of rounding off, catch and tear the edge of the drawing paper, and catch the drawing pins, thus splitting the T-square blade. Again, he might just as well have made the T-square head a tight fit on the slide originally, because the play that is present is left to accommodate the extra thickness presented by the drawing pin heads. With the tacks he makes a rigid job, which does not allow for this. Also, the tacks either stand out too far and wedge the T-square fast, or the constant

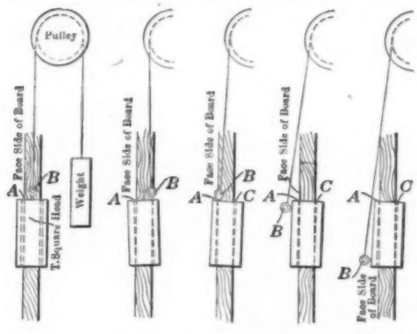


FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5

INCORRECT AND CORRECT METHODS OF SUSPENDING T-SQUARE

pressure forces them back into the blade and spoils their purpose.

Having met with the same difficulty and overcome it satisfactorily with practically no trouble and no further expense, I herewith describe it for the benefit of Mr. Rudolph and others who use the same type of board.

I may say the error is purely and simply in the suspending of the T-square from the pulley. If Mr. Rudolph will examine his T-square head, he will find it suspended in the manner shown in either Fig. 1 or Fig. 2, with the screw eye *B* either in the center of the head, as Fig. 1, which allows the head to hang straight and causes the gap *A*, through which the setsquare falls; or else the screw eyes set back behind the center of the head, as Fig. 2. This latter draws the head in such a manner as to cause a greater gap than before at *A*. It is in this way that the trouble arises.

Now if he will move the screw eye anywhere to the front of the center of the head, as in either Fig. 3, Fig. 4 or Fig. 5, the cord will draw the head in such a manner as to press the upper portion of the blade against the drawing, thus obviating any gap whatever at *A*.

Moreover, this method is not rigid, therefore, does not interfere with the space left for the thickness of the drawing pin heads; because, as the blade is passed over the pins the space is taken from *C* and given to *A*.

CLARENCE BOLTON.

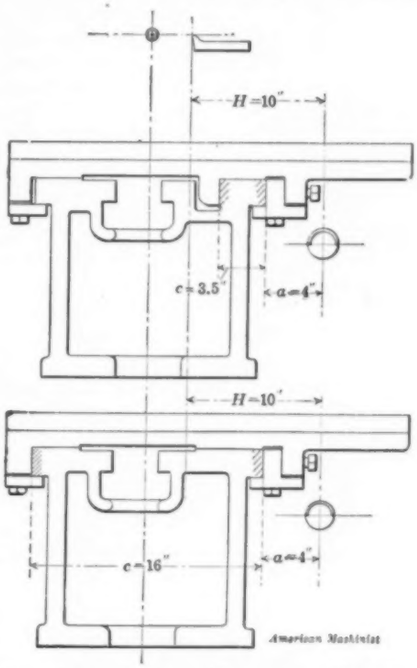
Accrington, England.

The Narrow Guide in Machine Tools

In Volume 33, Part 1, at page 346, Fred Horner gave examples of the use of narrow guides in machine tools. The advantage of narrow guides, as compared with the broad ones commonly in use, is not very clear, so the reasons for their use will be given here theoretically.

The line cut, Fig. 1, shows in cross-section a lathe bed with narrow guides, and Fig. 2 one with broad guides. For the sake of simplicity a rectangular guide is assumed. The width of the guide amounts in the first figure to 3½ inches; in the second to 16 inches. In each case the length of the guide is the same and the distance of the front of the guide from the center of the lead screw is 4 inches. In Fig. 3 is shown the ground plan corresponding to Figs. 1 and 2. The outline of the carriage is dotted.

The edge of the cutting tool working at a distance *H* from the middle of the lead screw, and in the plane shown in the cut, encounters parallel to the guide of the bed a resistance *P*. An equal pull must be exerted by the lead screw on the slide, so that the slide must have a right-handed moment $P \times H$. This is opposed by the guides with the left-hand moment $N \times h$ with relation to the slide. (For this consideration we regard only the moments falling in the plane of the illustration, Fig. 3, because only these are influenced by the width and position of the ways.) Only the outer quarter of the carriage guides will act as a bearing surface, and the normal pressures *N* may be assumed to be exerted in the middle of this quarter. When the carriage moves by means of the lead screw in a direction counter to the cutter pressure *P*, the normal forces *N* call out frictional resistances $N \times f$ (f = coëfficient of friction). These also must be overcome by the lead screw, so that the entire force falling in the axial direction of the lead screw amounts to $P + 2N \times f$. For a condition of equilibrium the algebraic sum of all moments acting on the slide



FIGS. 1 AND 2. LATHE BEDS WITH NARROW AND WIDE GUIDES

must be equal to zero. The equation of moments for the point 0 is as follows:

$$(P + 2Nf)\ a + P\ (H - a) + Nfc - Nh = \text{zero}.$$

Transposing this in terms of the normal pressure *N*, we get:

$$N = \frac{PH}{h - f(2a + c)}.$$

In this equation the values *a* and *c* enter as a multiplier of the coëfficient of friction. If this coëfficient were infinitely small, the normal pressure *N* would be entirely independent of the breadth of the guide and its position in respect to the lead screw; that is, the distance *a*. Since, however, *f* is always greater than zero, the quantities *a* and *c* have an appreciable influence on the magnitude of *N*. Therefore, with given values of *P*, *H* and *h*, the factor $(2a + c)$ in the above equa-

tion is to be kept as small as possible, in order that N may be small. If the middle of the lead screw lies on the other side of the front guide surface, say between the guides, then a has to be given a negative sign.

Let us substitute in the above equation the following numerical values:

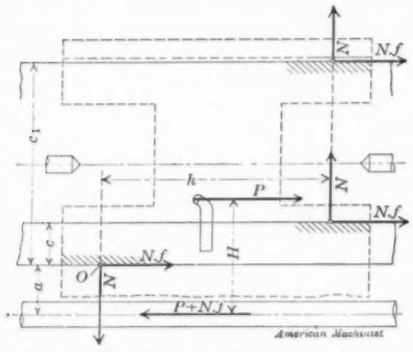


FIG. 3. TOP VIEW OF FORCES ON LATHE BED

$P = 2000$ pounds; $H = 10$ inches; $h = 18$ inches; $a = 4$ inches; $f = 0.2$. Then, for a value of $c = 3.5$ inches (Fig. 1), the normal pressure $N = 1274$ pounds, and the pulling force from the lead screw must be $(P + 2Nf) = 2510$ pounds. If c equals 16 inches (Fig. 2), then we get the corresponding forces: $N = 1516$ pounds and lead-screw pull $(P + 2Nf)$ must be 2606 pounds, which is almost 100 pounds greater than before.

Hannover, Germany. OTTO MOOG.

Compulsory Letters of Reference

Having read the article by Employer re Compulsory Letters of Reference, on page 601, I entirely agree with him and would further his arguments by giving my own experience, which throws light on another side of the case and which I am sure has affected many others. In 1900 I was employed by a large firm in the South of England with whom I stayed 5½ years. Shortly after leaving I wrote for a reference to be used in an application then in hand and got in reply a statement to the effect that the firm gave no references but would be pleased to give a suitable account of my services to any other firm referred to them. Some months ago I applied for a berth elsewhere and referred them to above firm. The reply received by my prospective employer was to the effect that both the manager and foreman under whom I had been employed were no longer with that firm and as no special record of my services had been retained they regretted, etc. Consequently I have lost 5½ years of good work owing to this unfortunate combination of circumstances.

At the same time it must be borne in mind that a good reference is of doubtful value, it being the practice of many firms to ignore such papers and to make private inquiries regarding the applicant. I have been told that references are of no use because they are often given to get rid of a man quietly.

Sheffield, England. P. F. JAMES.

Correct Seating of Ball Thrust Bearings

In ball-thrust bearings it is desirable that all of the balls should carry, and each its proportionate and equal share of the load.

With the common form, Fig. 1, eacn ball will carry an equal share of the total load, provided there is parallelism between the top surface of the upper washer and the seat that supports the lower surface of the lower washer. But as that parallelism must be actual within a small fraction of a thousandth of an inch, it is rarely practicable to secure it. The ball bearing itself may be made accurately enough, as it lends itself to precision by grinding; but every practical machinist knows that such accuracy of the seat is

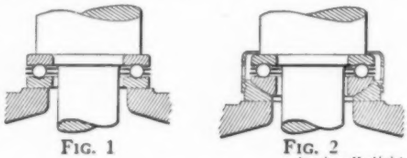


FIG. 1 FIG. 2

SEATS FOR BALL-THRUST BEARINGS

not obtainable in a machine frame or part such as usually receives the bearing.

For that reason the ball-bearing maker provides the ball bearing itself with an automatic compensating means—see Fig. 2 of a Hess-Bright construction—which consists of a ball surface for the bottom of the lower race fitting into a concave ball seat in a supplementary supporting washer, the whole incased with slight freedom in a sheet-metal cup. Sometimes the lower concave washer is not supplied, the user preferring to furnish that himself.

In the AMERICAN MACHINIST, page 606, the substitution of a conically concave lower washer for the spherically concave lower washer of Fig. 2 is advocated, this notwithstanding the statement of the advocate himself that the construction is theoretically wrong; the alleged justification is twofold: Smallness of error and difficulty of producing a spherical concavity as compared with a conical one.

Taking up the latter difficulty first, it will be found to disappear as soon as very simple special apparatus is provided; with such apparatus the cost of the correct spherical concavity is no greater than that of the incorrect conical one. Why, therefore, should the manufacturer of the ball bearing not furnish the correct article rather than the incorrect one? Surely the small investment in the special apparatus cannot be held to be a legitimate reason!

Now as to the first reason: alleged smallness of the error. The tilting of the spherical seat of the bearing in the coned seat of the lower washer is accompanied by a lift. This lift may be small for a small tilt, but it is present. The tilting force is a component of the thrust load and smaller than that. But the resistance to lifting is equal to the load. Proper functioning could thus be possible only if part of an original force were greater than the entire force—an absurdity manifest on its mere statement.

It is thus clear that the substitution of a coned cup for a spherical cup fails utterly of the object sought and had better be discarded as an utterly useless and expensive substitute for the flat seat of Fig. 1. As actual compensation to secure equal load distribution over all of the balls is a necessity in by far the greatest majority of cases, the arrangement of Fig. 2, which is used by the majority of makers of ball bearings of the better class, is necessary.

The adyocate of the coned cup argues from the fact of his being alone in its use that the arrangement must be unknown to others. Is it not more likely that these others are too well aware of its inadequacy to employ it?

HENRY HESS.

Philadelphia, Penn.

Circular Arc Ellipses

The ellipse is not circular at any point, therefore, there can be no true substitute made up of circular arcs. The following is the best empirical ellipse I know of, having the virtues of adaptation to all

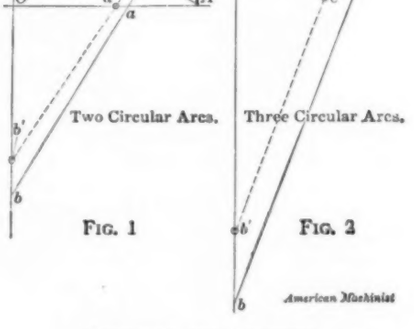


FIG. 1 FIG. 2

CIRCULAR-ARC ELLIPSES

proportions of diameters and freedom from special rules and elliptic properties.

On the semi-diameters OA and OB, draw the rectangle $OACB$; draw the chord AB and draw Cab at right angles to that chord. The points a and b are the true centers of curvature corresponding to the extremities of the two axes, and

the circular arc *A n* lies wholly inside and *B d* wholly outside of the true curve.

Now draw the free hand ellipse *B p A* to suit the eye and tangent to the two circular arcs. Ink it in with the curved ruler, or find two or more centers (in the case of Fig. 1, at *a'* and *b'*) from which satisfactory arcs can be drawn by the compass.

With such proportions as those shown in Fig. 2, three circular arcs are required, the centers being at *a'*, *b'* and *c'*. Point *c'* must lie at the intersection of radii *b' f* and *a' p*, which latter are found by trial as in Fig. 1, with the aid of points *a* and *b* and their arcs *A n* and *B d*.

GEORGE B. GRANT.

Lexington, Mass.

Confusing Use of the Term Scientific Management

Some of your criticisms of scientific management in recent issues are liable to give the impression that scientific management and the Taylor system are the same thing. Your article on page 773, "The Machinist's Side of Taylorism" is particularly liable to give this impression. Mr. Taylor's ideas of management differ greatly from those of many other engineers, and, in justice to the others, the difference should be shown.

Our aim throughout has been to encourage individuality and to arouse everyone in an establishment to think and to consider the reasons for everything that is done—a thing no gorilla could possibly do. We have absolutely no sympathy with any theory which would permit of a comparison of an honest, conscientious man with a "gorilla"—"intelligent" or otherwise. Some of the best suggestions and the best paying improvements have come from men in the ranks, and these men have always been suitably rewarded. In fact, in some cases, the liberality of the reward has been an agreeable surprise to the men. Any organization which endeavors to center all the thinking in one department is vitally weak.

The human element must always be studied and all ideas of class distinction eliminated. Some of the best results, both in increased output and decreased costs, have been accomplished by making the work easier and more pleasant for the workmen. In one specific instance the output of a plant was increased 20 per cent. by providing proper lighting facilities. In another instance a decided increase in output was obtained by so arranging the work that it did not have to be lifted. In still another case profitable results were obtained by installing a ventilating system which removed disagreeable gases and dust.

The majority of men are not loafers, but do the best they can under discouraging conditions. Who can blame a workman for taking a much longer time than necessary on a piece of work if he knows that when the job is completed, he must hunt for another piece of work and probably bring it in himself? The conditions and not the men are at the bottom of inefficiency.

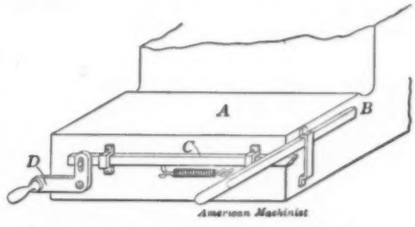
Scientific management, as we understand it, endeavors to uplift the workman, encourage him to think, better the working conditions, improve the machinery, provide adequate records, establish standards, provide the means of attaining the standards, and to so plan and despatch the work as to eliminate delays.

C. J. MORRISON,
Dept. of Effective Organization,
Suffern & Co.

New York City.

Safeguards for Punches and Dies

In the article "Safeguards for Punches and Dies," by Oberlin Smith, on page 469, he stated: "The only safe rule to follow, as a preventive of all the different kinds of accidents above referred to, is *to never* put fingers, hands or arms *between dies* while the flywheel or gearing of the press is in motion, even though the clutch may be fastened out of action by a clutch lock."



SAFEGUARD FOR PUNCHES AND DIES

Now it is not always possible to place the blank between the tools automatically, or with suitable appliances, but it is continually necessary in single work, to insert the piece by hand.

The great danger of injury therefore confronts us still. I have worked in a pressing and stamping shop, where unfortunately it often happened that the workmen cut their fingers off. Nevertheless, the victim generally claimed that the press had not stopped. I ascribed it, however, to tripping with the treadle. The workman accustoms himself to the rhythm of the motion, and if through any circumstance, his hands remain a moment longer than usual between the dies the accident has happened.

The way to protect the workman against injuries is very simple. Of devices for pushing the hands out of harm's way, I will not speak of here since I am not familiar with them. I think, however, that these sometimes can only be applied with difficulty, or not at all.

Before all things, tripping by a treadle ought to be avoided. The workman should be compelled to use both hands in starting the press.

In the illustration *A* represents the table of a crank-press, *B* the lever, which throws in the coupling to start the press. Under this lever slides the latch *C*. If a man wants to set the press in motion, he must first pull back the latch *C* by pressing down the bell crank *D*. Not until this is done can the lever *B* be moved. The lever is restored to its initial position, in a familiar manner, by a spring, thrusting back the latch *C* which has a beveled end for the purpose. A spring then restores the latch to place.

This simple arrangement can be easily applied to any press and a new one may be equipped with it without increased cost. I specify this device for all presses, and the builder has never charged me an additional sum for it. It has performed excellently in service, a decrease in production not having been discoverable, because the workman becomes very quick with the two handles. Personal injuries are now completely avoided.

A failure of the stopping device, or a running on of the press because the coupling box sizes, are, in my estimation, of extremely rare occurrence, since on one hand the clutches are reliably made, and on the other hand they are generally properly lubricated.

The press manufacturers, however, would deserve gratitude if they would so construct the tripping device on their presses that *both* hands are necessary to work it. I am firmly convinced that accidents would then occur far less often.

HERMANN BUDDE.

Ohlings, Rheinland, Germany.

Scientific Management

I am amused at the criticisms of Mr. Hudson on page 773 and of "Entropy" on page 942, and of others appearing at different times and places. What amuses me most about the Taylor critics, is that they all confess that they do not know anything about the Taylor methods of their own personal experience, but criticize only on a basis of reading about them.

Now I am not a scientific manager, but I have seen the Taylor system at work, and as soon as my conditions will justify it, I want to adopt it.

This is a mighty poor time in the history of the human race to say that a thing cannot be done because some fellow around the corner might be doing that very thing today, or if he is not doing it yet, may do it tomorrow. In criticizing the Taylor methods from up a tree, the critics would not be so amusing if they would bear in mind that the things they say cannot be done, are being done every day, and some of them have been done for thirty years.

It seems to me that more helpful and more valuable criticism would come from those who have done the trick, rather than from those who have not. I am amused to find that he anticipates every one of the unfavorable criticisms that are being rushed into print, and the best of all, Mr. Taylor predicts a flood of fakes that is even now upon us in the shape of near-Taylor methods. It is funny that the fellows who have the "real-Taylor" stuff are mighty well satisfied with it, and those who are not satisfied with it have not got it.

Cincinnati, O. E. F. Du Brul.

The Taylor System Again

I have been very much interested in what Mr. Hudson has to present in regard to the Taylor system, on page 773. I am an earnest believer in the Taylor system. I also believe that very few workmen deliberately and intentionally "soldier" except in shops where the management has taught them to do so by two or three cuts in the piece rate. Three-fourths of our mechanics are just as honest and as far as they know how to be, just as industrious and efficient as anyone could desire. On the other hand, I know that 95 per cent. of all the workmen in this country are doing less than 60 per cent. of what they might do without physical injury or overexertion. In nine shops out of ten which I visit, I find a large proportion of the men wasting time and the remainder of the men helping them. These same men would wax highly indignant if you accused them of such a thing, and probably at least three-fourths of them would be perfectly sincere and honest in the belief that they were doing everything that a workman ought to do.

Let the Workman Do His Own Thinking

Another side of Mr. Hudson's letter interested me even more, namely, his objection to having his thinking done for him. There can be no objection to the average workman doing all the thinking that he wishes to do. When, however, his thinking is illogical, and the methods of work which he evolves by that thinking are inferior, I must, as a shop manager, object to his using those methods in my shop.

If the methods which the planning department evolves are better than those which he evolves, I want him to use the methods of the planning department. I want him to use the best methods for three reasons: It is best for him; it is best for me, and it is best for the community, that he should produce the largest amount of work in a given time. The workman's efforts are just as much a part of the productive capital of the community as is my shop. It is my duty as the director of his efforts, to see that they produce the largest possible return, just as it is my duty as the director of my shop to see that it is used in the most efficient manner possible. As a selfish individual, I am, of course, looking to see that I get the most money possible out of my investment. However, my investment has value, and I am enabled to make money from it, only as it serves the community.

Duties of the Shop Manager

Hence, as a shop manager, I must recognize a social duty to conserve the interests of the community by employing all of the capital under my direction at the highest possible efficiency. I cannot fulfil my duty to the community if I allow my workmen to originate and follow methods which are clumsy, unproductive and inefficient.

I had in my employ at one time an old patternmaker who liked to do his own thinking. Sometimes his thinking was good, but the majority of the time it was very poor. It nearly broke his heart one time when I reproved him for spending half a day in putting a piano finish on a pattern that was to be used but once. He liked to do good work and so long as his job was first class in every particular, it was no concern of his as to how long a time it took. Every pattern was made in the best possible manner and was beautifully finished, irrespective of the purpose for which it was intended. He expected on account of the superior *quality* of his work to receive better pay than the man who performed three times the service for the community.

Reasons for Extra Pay

One of the arguments which I have often heard advanced in connection with the Halsey premium plan and the Taylor system is that a man's pay ought to be proportional to his output. I cannot, however, agree to this. Usually when a man employs the proper methods of working as outlined by an intelligent planning department, it takes no more effort on his part, and results in no more wear and tear on his system, than if he had produced a third as much work by the haphazard methods ordinarily in vogue. Why should the man receive any more pay for his extra output if it requires no more effort on his part? For two reasons: First, in order to induce him to coöperate with the management in keeping the output at its maximum, and, second, because he is entitled, as one member of the community, to a reasonable share of the benefits of his increased production. When a workman, as a result of proper direction, does four times as much work as he did before, the value of this increased production ought to be so divided that all may benefit from it. It is not right that the workman should receive it all, because the increased production did not require a corresponding increase of effort on his part. It is not right that I should receive it all, because the value is created by the joint efforts of the workman, of myself, and of the community. And certainly the community should be willing that the workmen and myself should receive a part of the extra value so created.

Finally, Mr. Hudson errs in assuming that the only thinking which the average workman does is in regard to the methods which he employs in performing his work. If by means of the Taylor system we obtain for the workman an opportunity for shorter hours at larger pay, cheapen the cost of those things which he buys, and increase the amount of capital available for the construction of new and improved shops and factories, it is evident that the workman will have larger opportunities for leisure and enjoyment, that his children will be better educated; that he will himself have capital to invest in productive enterprises.

So far from becoming an automaton, the workman will become a person of greater leisure, intelligence and culture than he is at present. The Taylor system will eventually bring about an entire readjustment of society by giving to all industrious and intelligent men those advantages which we now believe to be only the heritage of the well to do, so that finally the only difference between the capitalist and the working man will be the amount of money which each one has invested in industrial enterprises, and there will be no material difference in their scale of living, their interests or their opportunities for reasonable leisure and culture.

Nashua, N. H. Frank E. Crissey.

Making Tracing Cloth Bite

On page 772, A. E. Lowe tells about trouble in chalking tracing cloth. If he will have his inking pen properly sharpened, and keep his ink in proper condition, he need not bother to use any stimulant to make his tracing cloth bite. The nibs of the pen must be of the same length, half round and almost dead sharp, and the ink in the same condition as it comes in the bottle.

Syracuse, N. Y. John E. Sweet.

In a paper presented before the New England Foundrymen's Association dealing with permanent molds, a development now becoming pretty well known, it was stated in connection with the question of durability, that 21,000 castings had been made in a single mold, each casting weighing 10 pounds, and the matrix still showing the original tool marks. The life of the mold does not depend so much upon the number of castings that are poured into it as upon the number of times it is allowed to become cold.

Design of Aluminum Castings*

By H. W. Gillett

The physical properties of aluminum demand special attention in the design of castings.

Thin sections should be avoided and good substantial patterns furnished.

*Read before convention of Automobile Engineers.

The lightness, beauty, and resistance to corrosion of cast aluminum, combined with its good strength in comparison with its weight, are bringing it into vastly increased use. All castings must, of course, be designed primarily with a view to the fitness for the particular use intended. Usually, however, there are several ways of designing an aluminum casting, any one of which would allow it to serve its purpose well, keep within the weight limit and still be a good proposition from the point of view of the machine shop.

The designer is usually closely in touch with the machine shop and well acquainted with its problems, but seldom, indeed, is he a foundry expert; could he realize the extrat labor, and hence the extra cost and delay in production, a seemingly slight point in his design may make in the foundry he would more often consult with the patternmaker and with the foundryman before completing his design.

The Designer and the Patternmaker

Owing to certain physical properties of aluminum, such as its high contraction on cooling and its weakness when just solidified—that is, its hot shortness—aluminum castings require more careful design than almost any other casting metal. If one examines the defective casting records of the individual patterns in a large aluminum foundry he is struck at once by the vast difference in the results from different patterns. Some patterns give uniformly good results, while others differing but slightly from them are extremely troublesome. Speaking broadly, almost 50 per cent. of the discrepancies between the number of molds put up and the number of good castings made may be traced to the door of the designer in one way or another, and about 25 per cent. more may be traced to the door of the patternmaker.

Cost and Delivery

Do not think that we look upon a designer and a patternmaker as the natural enemies of the foundry. On the other hand, they are keen to see that what they can do to aid the foundry without interference with the requirements which the casting must meet, will come back to them many fold in lower cost and in regularity of delivery. But it so often happens that the automobile engineer will say: "We know that particular design is a poor foundry proposition and that pattern is not made in the best possible way, but we cannot change that model now nor can we tie up production of our cars long enough to allow changing the pattern," that it is worth while to remind you that the time to go into these points is when a new model exists in the mind and on the drawing paper of the engineer, rather than when the car is being assembled.

Contraction on Freezing

In passing from the molten to the solid state, aluminum contracts a good deal; when a heavy and a thin section come next to each other, the thin place will freeze first. If the thin section is so situated as to lie between a heavy section and a gate or riser the supply of metal

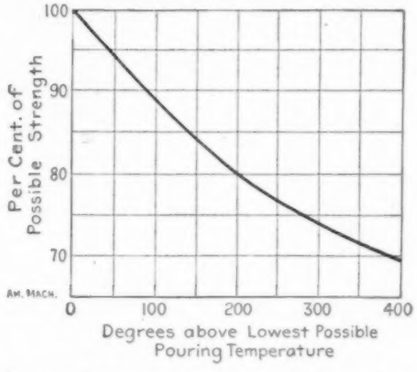


Chart Showing Decrease in Strength of Castings with Increased Pouring Temperature

is thereby cut off from the molten mass in what is to be the heavy part of the casting. The contraction on freezing has to take place, and instead of taking place uniformly over this heavy part and maintaining the exact shape of the mold, it will often draw away from a corner and produce a "shrink." We can induce the heavy portion to freeze more quickly by placing the chill in the mold at that point (a chill being a piece of some material, usually a metal having a higher heat conductivity than the pot of the mold). It is difficult to accomplish the end completely by this method; it greatly increases the time required to put up the mold and produces unsightly chill marks on the casting.

The ideal casting, therefore, is one of as nearly uniform section throughout as is practical, since that means that the whole casting solidifies at the same time, so that contraction is uniform.

Fillet

On account of the hot shortness of aluminum the shrinkage strains set up when a heavy section joins a thin one often cause the metal to give away entirely at that point, and a crack appears. If it is inevitable that light and heavy sections come together, the cooling strain should be distributed by joining the sections by a smooth curve, that is, a liberal fillet. This is on account of another physical property common to all molten metals.

A sharp angle tends toward the formation of a definite line of crystals, which forms a sort of cleavage plane and is a source of weakness. A break across a square bar of almost any metal will show distinct lines connecting the opposite corners, showing the arrangement of the crystals in this fashion, while a round bar shows no such lines. From this we can see the necessity for a liberal fillet. The sharper the angle at a change of direction, or the greater the difference of thickness at a change of section, the greater should be the radius of curvature of the fillet. If a second heavy part has a large boss and is near a first, both being joined by a thin section, the fillet should be more liberal than if only one were present.

Pouring Temperature

There is no one factor in foundry practice that more gravely affects the strength of the casting than the pouring temperature. The reason for this again, is, the speed of crystallization. The cooler the metal can be poured into the mold the more quickly it solidifies and the less time the crystals have to grow or arrange themselves, and the result is a mass of closely interlocking crystals forming a strong fine-grained material.

The effect of pouring temperature is well shown by a set of test bars, all of which were cast from the same pot of metal with exactly similar molds, the only variable being the pouring temperature. The average results obtained in this series of tests are given by the accompanying chart, which shows that the lower the pouring temperature the stronger the casting.

Thickness of Section

This has a distinct bearing on design, since the lowest temperature at which a casting can be poured is that to which the thinnest section will just escape a misrun. If the casting is so designed that this crucial section forces you to pour hot, all of the thicker parts will freeze too slowly and will be weaker than they should be. By slightly increasing the section of the thinnest parts, a casting could often be poured 100 degrees colder and the strength of the whole casting be increased at least 10 per cent. This is a matter

which is absolutely up to the designer. If the bulk of the casting is from a quarter to half-inch thick, one little part one-eighth of an inch thick will give us a resultant casting, on account of the high pouring temperature required, whose average strength is about 16,000 pounds per square inch, instead of 18,000 pounds or over. The call for lightness has led many designers to overlook this vital point.

Test Bars on Castings

The very great influence of the pouring temperature is the reason why separately cast test bars show only the quality of the ingot metal and nothing at all as to the strength of the corresponding casting, even though the test bar and casting may be poured from the same pot of metal. Your Standards Sub-committee has wisely specified that aluminum test bars shall be made on castings. Were this stipulation not made the foundryman who wished could pour the casting as hot as he pleases, allow his metal to cool way down and then pour separate test bars which would then show an utterly fictitious strength in comparison with the casting.

Pouring Temperature and Published Data

The general lack of attention to pouring temperatures, not only in commercial practice, but in most of the investigations on aluminum, vitiates a great deal of the published data on aluminum alloys and accounts for a great many irregularities and seeming contradictions in the results. In comparing the different aluminum alloys, really comparable results can only be obtained by pouring at the same number of degrees above the melting point of the particular alloy in question in all cases, thus allowing the same time for crystallization and producing an analogous condition.

The Pattern

After the designer has done his work it is up to the patternmaker to decide how the pattern shall be constructed. First of all, the pattern should be so made as to allow the use of molding machines wherever practical. If the patternmaker is not too much bound down by tradition he can often simplify matters greatly. For instance, in a crank case with several projecting pieces on the side, which would make it impossible to draw the pattern from the sand without the use of core work at the sides, by the simple expedient of making the pattern hollow and putting in a lever by which the pieces are drawn into the body of the pattern and the pattern then lifted out, a large amount of core work was eliminated.

Core Work

Core work always means trouble. It takes time to set cores in the mold correctly, and if a lot of small cores are used the danger of shifts is greatly increased. If, on the other hand, large cores are used, they must be made hard enough to allow handling them and setting them in the mold, which requires not only a solid core, but one reinforced by iron rods and wires. This makes them hard to crush, and on large cores inside of thin walls of metal, introduces danger of cracking. When we have a core completely surrounded by walls of metal it is a question whether the tensile strength of the metal as it solidifies is greater than the compressive strength of the core. Let the core be ever so slightly too hard and your casting is inevitably scrap. We have seen patterns requiring large and complex cores within walls as thin as 3/16 of an inch, from which patterns it was absolutely impossible to make castings, since any core strong enough to place in the mold would have too great a compressive strength for the metal to crush without cracking the casting.

Large and Deep Core Prints

If cores must be used, the core prints should be large and deep, so as to anchor the cores firmly without the use of chaplets to hold the cores in place, since it is impossible for the molten metal to fuse a chaplet into the body of the casting, without pouring at a temperature far above that necessary to give the greatest strength. When a job requires cores, the first question that should be asked by the patternmaker is if that pattern cannot be made so as to allow the use of green-sand core, or at least a green-sand half. Green sand will crush and give away when the casting contracts on cooling, where a hard, dry sand core will not crush and will crack the casting.

The foundry is called upon to make castings of ever greater complexity, and the core work required has increased amazingly in the last couple of years. Core rooms once fully adequate for a given molding room are now being overcrowded and unable to cope with the demand for cores. This situation could be greatly improved if the patternmaker would put green-sand halves in all castings where it is possible to use them; and the results would be both cheaper and better.

Metal Patterns and Core Boxes Economical

If a considerable number of castings are to be made, wooden patterns and core boxes are an abomination. They warp and swell in use, dry out and crack apart in storage and wear out by abrasion from the sand and by the constant rapping necessary to allow the pattern to be withdrawn from the mold or the core box from the core. Good metal patterns and core boxes are an economy if many castings are to be made, or if few are to be made from the same pattern in successive years.

The Designing Engineer's Responsibility

The engineer who wishes to get good reliable aluminum castings and at a reasonable price, must then realize that the problem is not entirely up to the foundryman to whom he entrusts the handling, but that it is his problem as well. The responsibility for design is solely his, and if he will so proportion his castings as to avoid great inequalities in section or sharp changes in direction, and if he will use liberal fillets, if he will keep away from such thin sections that the metal must be poured too hot to get strong castings, if he will instruct his patternmaker to go as far as he can in avoiding dry-sand cores, if he will provide good substantial patterns, will specify the proper alloy and then see that the casting is made with proper care and with proper control of pouring temperatures, he will get castings that will allow him to utilize to the fullest extent all of the many advantages that aluminum has for his purposes. But he should not for one moment forget that unless the design is right, the best efforts of the foundryman cannot produce a casting which will have in the fullest degree those advantages which the perfect aluminum casting should have.

The designer is father to the blueprint, the blueprint is father to the pattern, and the pattern is father to the casting. Even though the relationship be remote, the designer should give his great grandchildren the best possible chance.

Liability Insurance Figures

In interesting contrast with the administration of liability insurance in this country, we have the rather startling figures prepared by the National Association of Manufacturers in their recent volume. During the last 25 years the sum paid into the German Contributory Mutual Social Insurance, which includes sickness, accidents and incapacity, has been $2,663,000,000. Of this the workers contributed 40 per cent., amounting to $1,064,000,000. They received as compensation 72 per cent. of the total amount, or $1,918,000,000. The cost of administration has been only 7¼ per cent. and there is a reserve fund equal to 20¾ per cent., or $552,000,000. When this is compared with the figures given for the United States, where the worker receives about 30 per cent. of the premiums paid, and the cost of administration, so far as the employer is concerned, eats up the remainder, it would seem as though we might profit considerably by following some of the German methods and the example set in this and similar industrial problems.

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American Machinist

Giving a Man a Record of His Services

The letter published in another column in regard to compulsory letters of reference points out a real grievance on the part of the workman—due entirely to a custom and not to any desire to be unjust. But time makes changes in the personnel of the management as well as of the shop force and an accurate statement of a man's record should be his, if he desires, no matter what the cause of his departure.

The custom of not giving a record was evidently inaugurated to avoid the trouble of making them out, and there was probably every intention of giving the record when asked. But unless an accurate shop record is kept of each man and is preserved for a long period, it is often impossible to give it when desired, as in this case.

The easiest and fairest way seems to be to give a man a statement of his service when he leaves, to use or not, as he sees fit. It simply means a moment's dictation—and saves keeping records for a long period.

Compulsion rather goes against the grain of most of us and hardly seems necessary, as any employer will see the justice of the request and grant it willingly, if it be made in a friendly spirit, rather than as an arbitrary demand.

The Cost of Avoiding Competition

The aim of many manufacturers is to get into a new line in which there is little or no competition. Those who are making what might be called staple goods, such as lathes, planers, millers and drillers, look longingly to some of the successful builders of special machines and envy them their comparatively free field.

But there is another side to the question, which is too often overlooked, but which can be verified in a heart-to-heart talk with almost any manufacturer of special or noncompetitive machinery. There are undoubtedly many advantages in being able to manufacture machines according to our own ideas of design, method of manufacture, and in other ways, without being afraid that some competitor will market his machine for a few dollars less. But we are altogether too apt to overlook the fact that the selling side of any business is just as important as the manufacturing, and we must not forget that it is usually far more difficult to sell an entirely new and novel machine than one of well established design.

If we look about the country, we see many manufacturers of standard machines who have built large businesses and gathered to themselves a goodly share of this world's goods, while there are comparatively few who have started out along entirely novel lines and reached the same goal with anywhere near the same amount of effort.

In other words, the evidence seems to point out the fact that with the same amount of skill, capital and business ability, it is easier to be successful in building a standard machine with all its competition, than in introducing a new machine into a clear field.

Nor is the reason hard to find. New machines require much more time and capital to introduce than standard machines. The customers must be educated up to its advantages and shown how to use it, while they already know how to use the lathe or planer and do not require to be convinced as to its merits. In other words, the maker of standard machines has the advantage of the momentum of years of tradition, while the novel-machine builder has the inertia of habit to overcome.

The Brains Outside the Office

Just at this time, when there is a leaning in some quarters toward discounting the value of the knowledge and experience of the man in the shop, it is interesting to read two clear-cut statements, both written by successful shop managers, and both emphasizing the value of such knowledge in carrying on time study and manufacturing operations.

We quote from a paper presented by John Calder to the American Society of Mechanical Engineers, entitled "The Assembling of Small Interchangeable Parts:"

"The writer does not favor the restriction of the ordinary shop foreman solely to productive supervision, but prefers to encourage them to compete freely with the time-study staff for the best results. If pains are taken to give publicity to all good suggestions adopted from foremen, a surprising amount of very profitable cooperation can be obtained from them, which enhances instead of diminishes their administrative ability."

The second statement is from a paper "Quantity Manufacture of Small Devices," by F. P. Cox, also presented to the American Society of Mechanical Engineers, and describes methods used by himself:

"Apparatus meetings are attended by the manager, engineer, cost department and superintendent, with their assistants who have the actual handling of the apparatus. The device is placed on the table and gradually dissected, each part being fully discussed when it is taken off, and the presence of the leading hand is considered essential during the discussion of the particular part or operation with which he is concerned. The leading hand, or gang boss, comes under the general foreman. He has direct charge of a rather small number of operators, and often a portion of his time is given to productive labor. More than anyone else he appreciates inconveniences and difficulties which arise in producing his particular part, and any organization which fails to profit by such knowledge is fundamentally defective."

One does not have to strain his idea of common sense to believe these statements.

New Publications

How to Read Plans. By Charles G. Peker. One hundred and four 4½x7-inch pages; 81 illustrations in the text. Industrial Book Co., New York City. Price, 50 cents.

This is the second edition, revised and enlarged, of a little book written to give a simple and practical explanation of the meaning of lines, marks, symbols, etc., used on architectural working drawings, so that such drawings can be easily and correctly followed by the workmen.

Scientific Management and Railroads. By Louis D. Brandeis. Ninety-two 6x9-inch pages; the Engineering Magazine. Price, $1.

This book is a reproduction of that part of Mr. Brandeis' brief, which covers the principles and results of scientific management as brought out in the testimony before the Interstate Commerce Commission at Washington. The hearing at which this testimony was given attracted a great deal of attention, particularly in the daily press, and it is gratifying to see that Mr. Brandeis' excerpts from the testimony and his arguments have thus far been preserved in book form.

Temperature-Entropy Diagram. By Charles W. Berry. 393 pages, 3½x6 inches; 125 illustrations. Published by John Wiley & Sons, New York. Price, $2.50.

This book is a mathematical discussion of the application of the temperature-entropy diagram to the analysis of the various thermodynamic cycles of operation of perfect gases, saturated steam and superheated vapors. Considerable space is devoted to flow of fluids, laws of mixtures of gases, gases and vapors, and vapors. Gas engines of various cycles are dealt with, including a study of the actual gas-engine indicator diagrams.

The latter half of the book deals with the steam engine, multiple-fluid or waste-heat engine, air compressors and motors, liquefaction of vapors and gases, refrigerating processes; ending with a chapter discussing the theory of Kelvin's warming engine.

The following tables are included: Properties of saturated steam from 400 degrees Fahrenheit to the critical temperature; hyberbolic and common logarithms.

Applied Thermodynamics for Engineers. By William D. Ennis. 438 pages 6x9 inches. 316 illustrations. Published by the D. Van Nostrand Company, New York. Price, $4.50.

A quotation from the preface of this work will not be amiss: "Thermodynamics is physics, not mathematics or logic. This book takes a middle ground between those text books, which replace all theory by empiricism and that other class of treatises which are too apt to ignore the engineering significance of their vocabulary of differential equations."

Some of the subjects dealt with in this book are as follows: Nature, effect and unit of heat; laws of gases, graphical representations of pressure-volume cycles, Carnot cycle, entropy, compressed air and the commercial compressor, hot-air engines; gas power, the producer, various types and cycles of engines, with details of gas action and efficiencies; theory of vapors, the steam engine and steam turbine in theory and detail, boilers, chimneys, stokers, etc., distillation, fusion, liquefication of gases, and mechanical refrigeration in detail. The application of the entropy diagram is used extensively in all mathematical analyses.

The work is meant for a textbook and includes many problems to be worked in accordance with the principles explained in each section.

Personals

H. L. Flather, treasurer and superintendent of Flather & Co., Nashua, N. H., sailed on June 17 for a six weeks' European trip.

J. J. Harvey, for several years connected with the American Locomotive Company, has become manager of the Powell Marine Engine Corporation, of Brooklyn, N. Y.

Earle J. Banta, formerly chief engineer of the Vulcan Steam Shovel Company, has been appointed general sales manager of the Davenport Locomotive Works, Davenport, Iowa.

Willard C. Brinton, formerly with the Westinghouse Electric and Manufacturing Company, East Pittsburg, Penn., is now assistant vice-president of the United States Motor Company, New York City.

Farley G. Clark, until recently electrical engineer of the P. T. and T. R. R. Company, has been appointed superintendent of the Westinghouse Electric and Manufacturing Company, Pittsburg, Penn.

D. J. Lewis, who was formerly manager of the Bundy department of the American Radiator Company, New York City, has become sales manager of the Lytton Manufacturing Corporation, New York City.

J. L. Sheppard, construction superintendent of J. G. White & Co., with headquarters at Carbondale, Penn., has resigned in order to join the staff of the New England Engineering Company, New York City.

Frederick W. Becker recently resigned as assistant shop superintendent in the hull department of the Mare Island Navy Yard, to assume the management of the Gasolene Safety Appliance Company, San Francisco, Cal.

W. H. Stillwell has just been added to the engineering and selling force of the J. S. Bretz Company, New York City. Mr. Stillwell has been associated with the Westinghouse Electric and Manufacturing Company.

Harry B. Eaton, for the past 10 years eastern manager for Hermann Boker & Co., has accepted the position of sales manager of Edgar Allen & Co., Ltd., Sheffield, England, whose main offices in this country are in Chicago. His eastern headquarters will be 71 Kilby street, Boston, Mass.

Charles A. Thistlethwaite, chief draftsman of the Elliot-Fisher Company, Harrisburg, Penn., has resigned to accept a similar position with the Lodge & Shipley Machine Tool Company, Cincinnati, Ohio. Mr. Thistlethwaite will be recalled by our readers as the author of several articles which have appeared in our columns.

Joseph V. Woodworth, formerly superintendent of the Harwood Manufacturing Company, Brooklyn, N. Y., and author of several well known books on machine-shop practice, is now with the Taft-Pierce Manufacturing Company, Woonsocket, R. I., as consulting engineer and expert in sheet-metal formation and punch and die practice.

A. Hamilton Church, consulting industrial engineer, and author of the "Proper Distribution of the Expense Burden," has commenced practice for himself, and is forming an organization to handle all departments of industrial betterment, efficiency work, routing methods and costs. His address is P. O. Box 1362, Boston, Mass.

Shop Equipment News

Geared Spindle Universal Miller

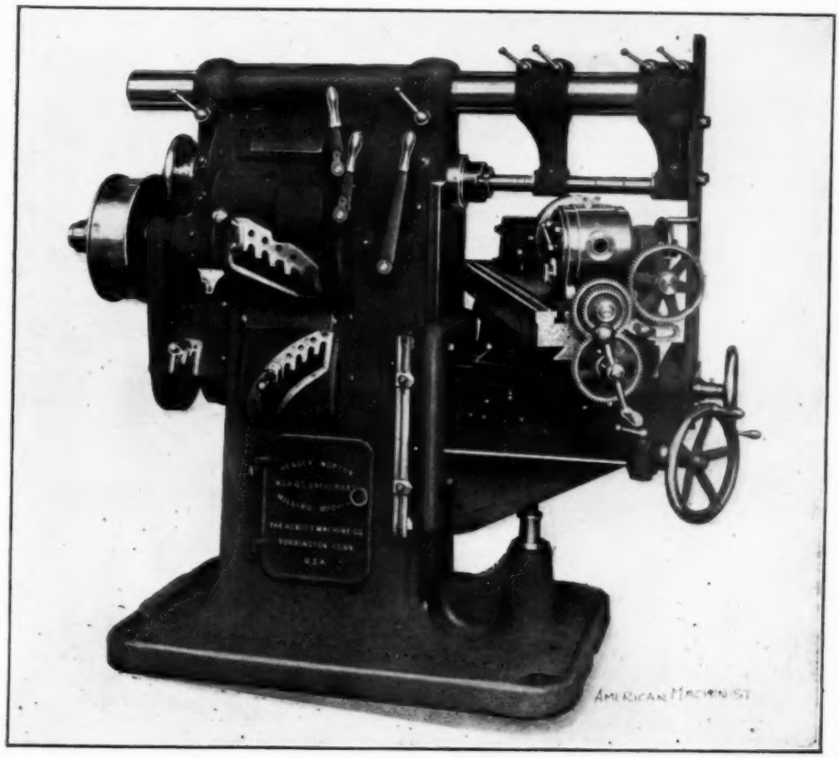
The accompanying halftone shows a heavy universal miller of the geared-spindle type, with a wide range of spindle speeds and feeds. The driving-shaft pulley engages the shaft through an expanding ring clutch, which is controlled by a lever located near the face of the column of the machine. This clutch facilitates making speed changes in the gear cone, on the spindle of which there are five. Double back gears are constantly in mesh with their relative gears on the spindle, and are engaged in the drive by a positive-toothed clutch combining with the gear cone to give 18 spindle speeds in direct progression.

The main spindle has taper journals which run in annular bearings fitted with ring oilers. The feeds are positive driven through chain and sprocket, of which there are 21, obtained by simply shifting levers in compound-gear boxes. They have a range of ¼ inch to 20 inches of travel per minute. The feeds are automatic and can be operated simultaneously and reversed while in motion.

All feeds are equipped with safety trips and the dividing head furnished is of heavy construction.

ANY and all new or improved machines, tools or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here — the machine shop news.
A more full and detailed description will be given — when it is real news — if it can appear here first — before it is sent to other papers. ALL descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German

The machine known as their No. 3 is a recent product of the Hendey Machine Company, Torrington, Conn.

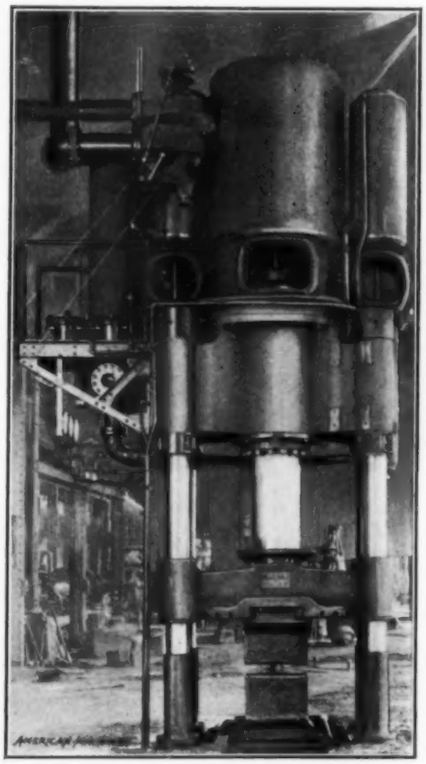


GEARED-SPINDLE UNIVERSAL MILLER

Steam Hydraulic Quick-acting Forging Press

The illustration shows an 800-ton steam hydraulic quick-acting forging press built by the Mesta Machine Company, Pittsburg, Penn., under license of Haniel & Lueg, Düsseldorf, Germany, the owners of the patents on this system of forging.

One of the principal and most important features is that the press is self-contained, that is, the steam and hydraulic cylinders are directly connected to each other. This allows the press to be operated at a high-speed and eliminates high-pressure piping and fittings between the



STEAM HYDRAULIC QUICK-ACTING FORGING PRESS

intensifier and the press. As will be seen the intensifier is directly connected and self-contained.

The press exerts a continuous pressure, which forces the semi-fluid material of the forging to flow under compression, which process tends to increase density of the material.

These presses are built in the four-column type from 400 tons to 15,000 tons. They are also built in the single-frame type in sizes from 100 tons to 450 tons.

A Form Milling and Cam Cutting Machine

This machine cuts any type of face, edge, disk or cylinder cam, and will do any kind of form milling, as shown in Fig. 2.

The machine is simple in construction. A base supports two uprights carrying the table and crossrail. The table carries the leader, work and feed mechanism. The crossrail carries a long slide, upon which are mounted the cutter-spindle head and the pilot. The tables are provided with T-slots and are bolted to large worm wheels, supported in vertical bearings. Both of these wheels are driven from the same shaft by means of worms, as shown to the right in Fig. 1. When cutting disk cams, the leader is clamped to one of these tables and the blank to the other. Both are centered by means of bushings fitted to holes in center of tables. The machine is equipped with the Garvin positive feed-change box which, in connection with the three-step cone, gives 36 changes of feed for the machine. A turn of the crank will change the feed; a right-hand turn giving an increase, and a left-hand turn a decrease in geometrical progression. The machine can be changed while the machine is in cut.

The crossrail is carried on the front of the uprights, and is under the control of elevating screws that run on ball bearings. The upper horizontal surface of the rail has a V-grooved, tool-steel ball race, carrying a long row of balls. The opposing surface of the slide has one similar to it, thus supporting the weight. At the lower edges of the slide and rail are two opposed tool-steel surfaces, between which are two rows of balls, which take up the thrust, thus making the slide travel back and forth with ease and reducing the friction, so that the cutting of sharp-angle cams is greatly facilitated. Suitable adjustments and take-ups are provided.

Mounted to the slide is a handwheel, connecting with a gear that meshes with a rack on the crossrail. This is used for longitudinal adjustment of the cross slide when setting up. The counterweight for the slide is shown at the left-hand end of the machine, but can be placed on the other end if desired.

The spindle main bearings are taper, running in self-oiling boxes. A drawn-in rod is provided. The spindle is driven by universal joint and telescoping rod from the countershaft, through changeable back gearing or direct to the spindle, giving high speed without gearing.

The spindle head has sufficient vertical adjustment for setting the cutter for ordinary jobs, without moving the rail.

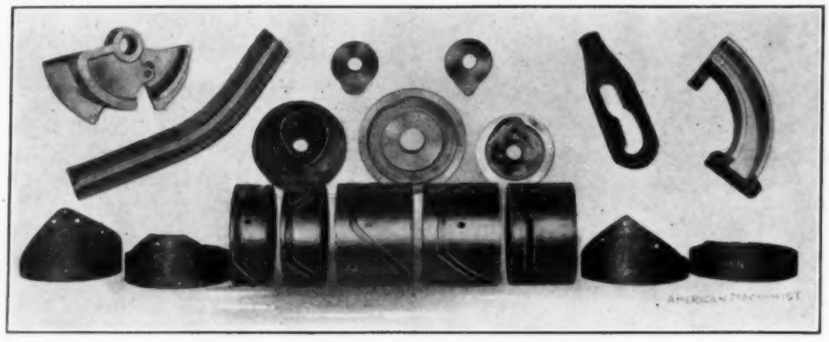


FIG. 3. SAMPLE CAMS AND LEADERS

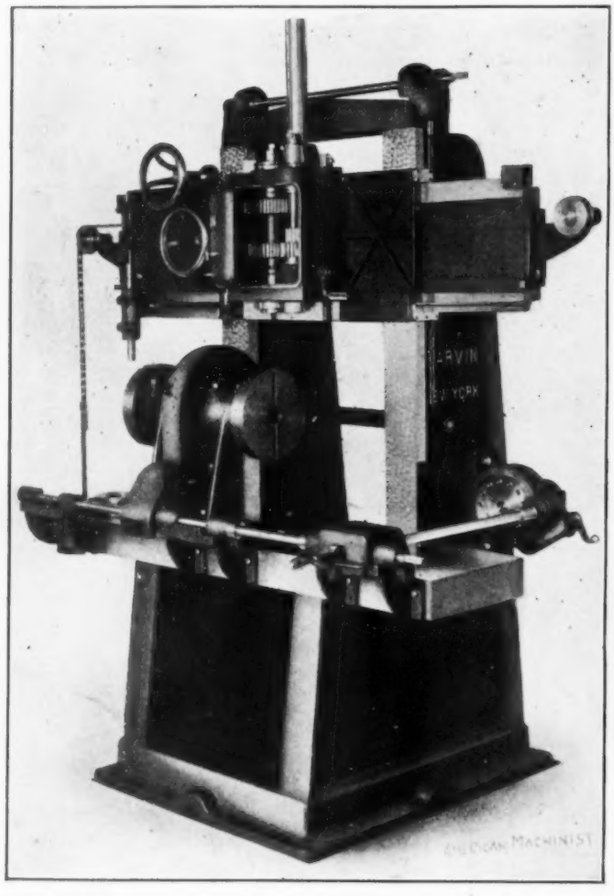


FIG. 1

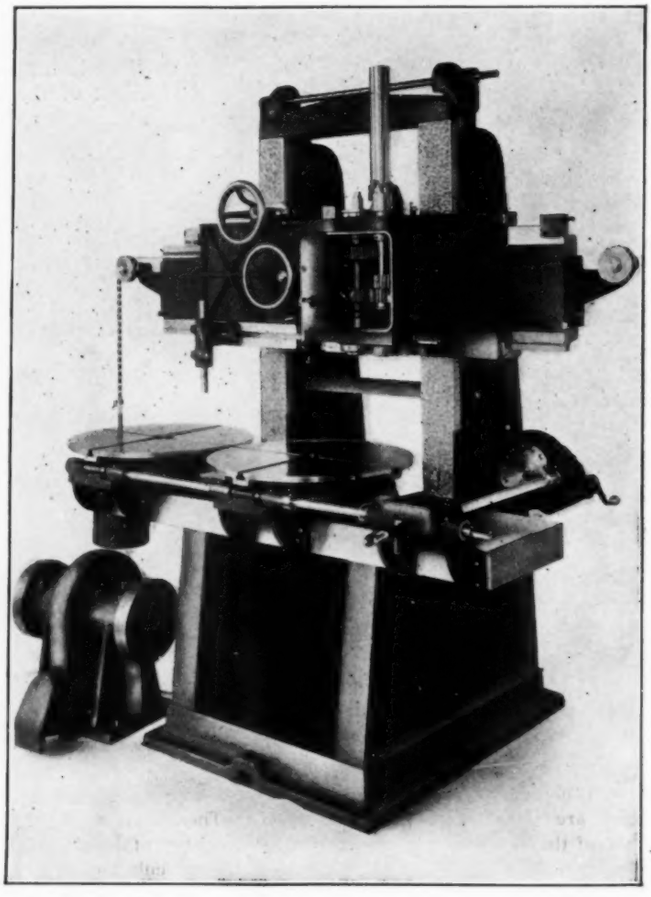


FIG. 2

FORM-MILLING AND CAM-CUTTING MACHINE

Stops are provided for the movement of the slide on the crossrail, and for the vertical movement of the spindle head. Thus it is possible to bring both rail and cutter spindle to predetermined positions when changing cam blanks, or for any other reason.

Reversing mechanism is provided, so that the cutter can be rotated in either direction. The illustration to the left, in Fig. 1, shows the machine set up for cutting barrel or cylinder cams.

The large upright bracket has a spindle which has faceplates fastened to each end of it. These faceplates have slots, which are used for both timing and driving the leader and blank. The drive is transmitted from a bevel gear, on main driving shaft to a worm and large worm gear on the spindle.

It is possible to cut cams of the same, larger or smaller diameter than the leader by changing the center distance of the pilot and leader, and the cutter and blank as desired.

Fig. 2 shows a group of cams and leaders. The leaders are very simple and inexpensive to make. They are made from sheet steel about ⅛ inch thick for cylindrical cams; they are bent and formed to shape and screwed to master hubs or barrels.

The machine is adapted for circular milling, either on the face or periphery of a cylinder. The machine weighs 4100 pounds and occupies floor space 51x83 inches. It will cut any type of cam from 2 to 24 inches diameter. The spindle has a No. 10 Brown & Sharpe taper hole and will carry cutters from 3/16 to 2½ inches diameter. A throw of 7 inches is provided for barrel cams. This machine is built by the Garvin Machine Company, New York.

Automatic Bevel Gear Chuck

The halftones herewith show an automatic bevel gear chuck designed for holding bevel gears by the outside tooth angle while grinding or boring.

The chuck can be fitted to any ma-

FIG. 1. AUTOMATIC BEVEL GEAR CHUCK

chine having a hollow spindle and by turning the handwheel the jaws, of which there are three, draw the gear to the body of the chuck which has been turned to the proper angle.

Fig. 1 shows the chuck assembled while Fig. 2 shows it set up on a lathe.

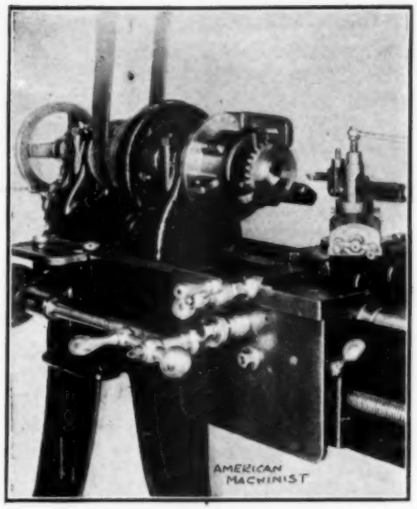


FIG. 2. CHUCK SET UP IN THE LATHE

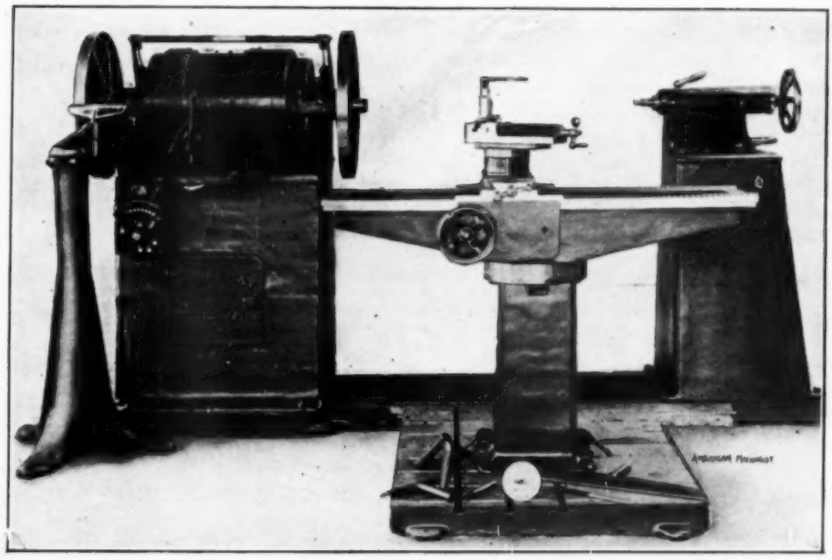
The chuck is made in 8 standard sizes to accommodate gears ranging from 3¼ to 18¼ inches in diameter by the Stvanek Tool Company, Bridgeport, Conn.

100-inch Patternmaker's Lathe

This lathe swings 100 inches over the base plate and can accommodate work 7 feet long between centers.

The headstock spindle, driven by a variable-speed motor, has minimum and maximum speeds of 22 revolutions per minute and 1100 revolutions per minute respectively. The headstock is double back geared, and the back gears are placed in mesh by means of levers and connecting rod, shown over motor bonnet. The sliding back gear is manipulated by means of lever shown on front of headstock column.

Motor and all gears are guarded, and rawhide pinions running with cast-iron gears, tend to eliminate noise. The tailstock is moved by means of rack and pinion on back side of tailstock. The machine is a recent product of Fay & Scott, Dexter, Maine.



100-INCH PATTERNMAKER'S LATHE

Railway Master Mechanics Association

The forty-fourth annual convention of the American Railway Master Mechanics' Association was held at Atlantic City, N. J., June 14 to 16. Extracts from some of the papers will appear at intervals.

The exhibit of machines used in machine construction was not as large as in some former years, but was interesting and contained a few machines which had not been previously exhibited.

Among the exhibitors were: American Tool Works Company, American Vanadium Company, Armstrong Brothers Tool Company, Armstrong-Blum Manufacturing Company, Ajax Manufacturing Company, Charles H. Besly & Co., Bullard Machine Tool Company, Bowser & Co., Carborundum Company, Cincinnati Gear Cutting Machine Company, Cleveland Twist Drill Company, Cochrane-Bly Company, Colonial Steel Company, Crucible Steel Company, Chicago Pneumatic Tool Company, Chisholm & Moore Manufacturing Company, Celfor Tool Company, Cincinnati Shaper Company, Coe Manufacturing Company, Cooper-Hewitt Electric Company, Detroit Hoist and Machine Company, Joseph Dixon Crucible Company, Davis-Bournonville Company, Duff Manufacturing Company, Electric Controller and Manufacturing Company, Foote-Burt Company, Walter H. Foster Company, Goldschmidt Thermit Company, General Electric Company, Greene, Tweed & Co., Edwin Harrington, Son & Co., Hendey Machine

Company, Independent Pneumatic Tool Company, International Correspondence Schools, William Jessop Steel Company, Keystone Drop Forging Company, Landis Tool Company, Landis Machine Company, Linde Air Products Company, Lucas Machine Tool Company, David Lupton's Sons Company, Manning, Maxwell & Moore, Matthews Davis Tool Company, Niles-Bement-Pond Company, National Tube Company, A. O. Norton, Inc., O. K. Tool Holder Company, F. E. Reed Company, Royersford Foundry and Machine Company, Reliance Electric and Engineering Company, Sprague Electric Company, William Sellers & Co., Topping Brothers, United Engineering and Foundry Company, Union Manufacturing Company, H. B. Underwood & Co., Van Dorn & Dutton Company, Vandyck Churchill Company, Warner & Swasey Company, the Westinghouse Companies, Windsor Machine Company, Yale & Towne Manufacturing Company.

The Bullard exhibit consisted of a new 42-inch vertical turret lathe, recently described, and a new 64-inch boring mill, known as the Maxi-Mill. This machine has many new features, including massive housings of semi-circular design, which afford a rigid support for the center of the rail through a substantial extension, which meets a guide forward by the center of the housings. This ties the rail to the housings at three points and avoids spring of the rail. Both of these machines have continuous-flow lubrication, a noticeable feature being the absence of gearing noise. This is due to the use of alloy gears and copious lubrication at all times.

The Niles-Bement-Pond exhibit was outside the convention hall, and showed a new car-wheel lathe in operation. A new air chuck was shown by the Union Manufacturing Company. The Windsor Machine Company had a large 2¼-inch multiple-spindle Gridley, as well as a 4⅛-inch single.

The Cleveland Twist Drill Company had a new Foote-Burt vertical driller, equipped for drill testing, and performed some remarkable feats with drills up to 3¼ inches in diameter, drilling 5 inches per minute in tough bar steel. In cast iron a drilling speed of over 33 inches a minute was secured with a 1¼-inch drill, a feed of 0.10 inch per revolution being maintained. Both milled and forged drills were used, the former standing the greatest punishment.

The driller was equipped with a 20-horsepower Reliance motor, a small auxiliary motor under control of a push button, being geared to the large motor armature to draw it in and out of the field to regulate its speed. The large motor was started and stopped by push buttons, as is the regulating motor. A Warner speedometer attached to the driving shaft shows the spindle speed at all times. This made a very complete drill-testing machine, which will be illustrated later.

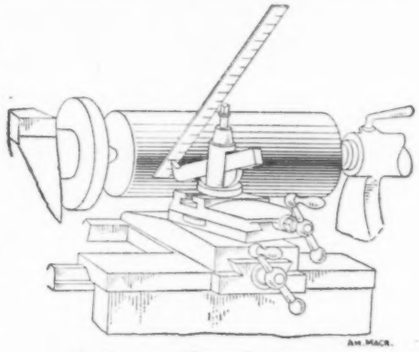
Two other interesting drillers, shown by the Walter H. Foster Company, are the large all-geared multiple-spindle machines, similar to that illustrated on page 182.

The other is a new design of radial driller, the motor being mounted vertically on the back of the saddle and geared direct to the spindle. The feed is entirely without gears, air and hydraulic pressure being used instead. The air from a regular shop compressed-air system is admitted to the top of a piston surrounding the spindle, the feed being determined by the speed with which the oil under the piston is allowed to escape into an auxiliary chamber. The feed is controlled by suitable valves and has worked out very nicely on several large drillers for boiler plates at the Schenectady shops of the American Locomotive Company. The design is by Messrs. Lassiter and Bocorcelski.

A Simple Test Indicator

By Edward Pazik

In many shops there are very few men who have a test indicator. By this method a mandrel can be tested or a lathe job trued up within a thousandth or less. Set the tool as low as possible and about 3/32 inch away from the piece to be tested. Take a scale which will be somewhat less than a sixteenth thick (a narrow one serves best) and place it between the tool and the work, letting it extend below the edge of the tool about an eighth of an inch. Then place your finger on the scale as low down as you can, and just hard enough to hold it against the work. As the piece rotates, if there is any perceptible movement of the scale, you will know that the job is not running true.



A Simple Test Indicator

Increasing Shop Capacities

Metal Working

NEW ENGLAND

The blacksmith shop of C. T. Holmes, Milford, Conn., was destroyed by fire.

The Worcester (Mass.) Pressed Steel Company is figuring plans for an addition.

The Harrington Cutlery Company, of Southbridge, Mass., will enlarge its factory.

David A. Turnbull, Willimantic, Conn., will erect a commercial garage on Main street.

Hankey & Co., of Rochdale, Mass., making machine knives, will build an addition to its factory.

Fire did about $10,000 damages at the plant of the Locke Regulator Company, Salem, Mass.

The Lamb Knitting Machine Company, Chicopee Falls, Mass., will erect a five-story addition to its plant.

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

The New York, New Haven & Hartford Railroad Company will build a machine shop at New Haven, Conn.

The Wright Wire Company, Palmer, Mass., has started work on large addition to present factory, to be completed by fall.

C. H. Bartlett, Bangor, Me., is having plans prepared for a new factory which will be leased to the Penobscot Machinery Company.

The Heald Machine Company, Worcester, Mass., building grinding machines, is erecting an addition which will practically double present floor space.

The Snell Manufacturing Company, Fiskdale, Mass., is to erect a two-story addition to present factory. The company manufactures machinists' supplies.

The Universal Trolley Wheel Company, Springfield, Mass., has been organized with a capital of $300,000. Directors, Lewis J. Petlow, president; Jason W. Steel, treasurer.

The Peavey Manufacturing Company, successors to the Bangor (Me.) Edge Tool Company, will move its plant to Brewer, Me. A new factory will be erected in that place.

The Auto Repair and Salvage Company, East Hartford, Conn., has incorporated with a capital of $25,000. Incorporators, George W. Ripley, Elliott B. Wallace, Harry W. Reynolds.

The Machine Nut and Bolt Company, of Bridgeport, Conn., has been incorporated to manufacture bolts, nuts, etc. Capital, $50,000. Incorporators, Frank C. Johnson, D. Homer Jennings, Edward K. Nicholson.

The Artistic Bronze Company, of South Norwalk, Conn., will locate in Bridgeport, where new factory is now being erected. The company manufacturers bronze and brass furniture trimmings and builders' hardware.

MIDDLE STATES

A garage will be built at Wynnewood, Penn., for L. J. Fullam.

The Burlington (N. J.) Garage Company is to build a new garage.

E. A. West will build a garage at 2439 Park avenue, Indianapolis, Ind.

The Erie (Penn.) Stove Manufacturing Company will enlarge its plant.

The Skinner Engine Company, Erie, Penn., will erect an extension to foundry.

The Oliver Foundry and Machine Company will build a new plant at Ironton, O.

The Michigan Washing Machine Company, Muskegon Heights, Mich., is erecting an addition.

Another addition to Sweet Brothers' factory in Lestershire, N. Y., is being planned, it is said.

The Austin Automobile Company, Grand Rapids, Mich., will move its plant to South Norwalk, Conn.

The Continental Motor Company, of Muskegon, Mich., will build a large branch plant at Detroit.

The C. & O. Railway Company is improving its shops at Peru, Ind. New machinery will be installed.

The plant of the Boss Knitting Machine Works, Reading, Penn., was destroyed by fire. Loss, $8000.

The Ford Motor Company, of Detroit, is having plans prepared for an extensive addition to its plant.

The Niagara Falls (N. Y.) Metal Stamping Works is erecting an addition to its plant on Tenth street.

The Davison-Namack Foundry Company, Ballston Spa, N. Y., contemplates installing the open-hearth process.

National Boat and Engine Company, of Augusta, Me., has incorporated for $15,000 to establish a branch works in Chicago.

The American Hoist and Manufacturing Company, Hamburg, Penn., is said to be contemplating the erection of a larger plant.

The Cole Motor Car Company, Indianapolis, Ind., has plans under way, it is said, for one of the largest automobile plants in the country.

The Crescent Tool Company, Jamestown, N. Y., manufacturing special machinery and hardware specialties, will build a two-story addition.

It is stated that the American Steel and Wire Company will make improvements at its South Sharon, Penn., works to cost about $200,000.

The Ford Motor Company, of Detroit, Mich., is having plans drawn up for new buildings and is planning greatly increased production.

The Toledo-Flanner Boiler Company, Toledo, O., is having plans prepared for an addition to its plant at Cleveland and Michigan streets.

Permit has been taken out for a car-building shop addition to the plant of the Harlan & Hollingsworth Corporation, Wilmington, Del.

Plans and specifications have been prepared for a large addition to the plant of the A. T. Nye & Sons Company, of Marietta, O., founders.

The Bradley Axe Works has selected a site on which to erect a factory at Peekskill, N. Y. The Peekskill Industrial Association is interested.

James H. Knoll, manufacturer of washing machines, Reading, Penn., is to erect a three-story factory building, at 124 to 134 Maple street.

The Kennedy Manufacturing Company, Cleveland, O., will erect a factory at Elyria, O., for the manufacture of steam and gas-fitters' supplies.

It is reported that the Pittsburg and Lake Erie Railroad intends to build large shops and yards at New Castle, Penn., on land recently acquired.

Central Locomotive and Car Works, of Augusta, Me., will establish a branch in Chicago and have incorporated under the laws of Illinois for $450,000.

The Electric Welder Company, Kokomo, Ind., has been organized to manufacture electric-welding machines by Jesse Jackson, F. M. Ruddell, Conrad Wolf.

Security Sealing and Stamping Machine Company, Chicago, Ill., has been organized with $12,000 capital by Frank V. Lawton, James G. Brown, F. J. Back.

The Youngstown Sheet and Tube Company will erect an open-hearth steel plant of six furnaces and a blooming mill at East Youngstown, O., to cost $3,000,000.

Acme Metal Ceiling Company, Chicago, Ill., has been organized to manufacture metal ceilings by Smith Pykett, Jean Pykett, Albt Wendt. Capital, $25,000.

The Acme Supply Company, Lake street and Fifty-second avenue, Chicago, Ill., making railroad supplies, is enlarging its factory and adding more machinery.

The Coleridge Commercial Car Company, Detroit, Mich., has been incorporated to manufacture light delivery cars. John C. Lodge, president; J. G. Coleridge, manager.

The Ideal Gas Engine Works, Lansing, Mich., which recently acquired the Ideal Motor Works, at present in leased quarters, will erect plant as soon as site is secured.

Midwestern Car Supply Company, Chicago, Ill., has been organized with $25,000 capital to manuacture railroad supplies by George A. Chritton, J. G. Anderson, R. A. Raymond.

The Elliott Machine Company, Grand Rapids, Mich., is having plans prepared for a new plant to cost $100,000. The concern manufactures shoe-button fastening machines, etc.

The Kelsey Wheel Company, of Detroit, Mich., will soon erect an addition to its factory. The firm will manufacture the Booth demountable automoble rims in the new addition.

The Chicago Boiler Company, Chicago, Ill., has been organized to manufacture boilers, tanks, etc. Capital, $8000. Incorporators, August Krumholz, L. H. Shover, W. C. McHenry.

It is reported that the Quinn Manufacturing Company, of Kalamazoo, Mich., which manufactures plumbing supplies, has purchased site in Detroit on which plant will be erected.

Bingo Novelty Manufacturing Company, Chicago, Ill., has been incorporated to manufacture mechanical novelty goods by John E. Verkler, Frederick Kieler, James J. Marshall. Capital, $10,000.

W. W. Mills & Co., Chicago, Ill., have incorporated with $30,000 capital to manufacture and deal in machinery, dies, tools, etc. Incorporators, R. W. Mills, George C. Gault, G. J. Blaha.

The Justrite Vacuum Cleaner Company, Bloomington, Ill., has been organized to manufacture vacuum cleaners. Capital, $25,000. Incorporators, Lewis C. Walter, C. Burdette Gilmore, A. W. Rigby.

The Cleveland (O.) Electric and Machine Company, has been incorporated for $25,000 to manufacture machinery. Incorporators are S. J. Schwanzer, A. S. Klein, A. H. Bender and A. Marchanid.

Stronack Door Check Company, Chicago, Ill., has been formed with $15,000 capital to manufacture door checks, springs and hardware specialties by C. W. Braithwaite, G. L. Stronach, R. G. Stronach.

The Economical Generator Company, Montpelier, Ind., has been incorporated with a capital of $5000 by B. W Smith, T. C. Neal and L. W. Rawlings, to manufacture heat and power generators.

Samuel Bennett, Jr., is remodeling a building at Maynard and Junction streets, Williamsport, Penn., and will start a general repair shop and the manufacture of gasolene engines, also a patent valve.

The Cadillac Motor Sales Company, Cleveland, O., has been organized to handle motor cars and supplies and operate a garage by Carrie L. Straehley, Erwin O. Straehley, David P. Schorr, etc. Capital, $25,000.

The Herman Motor Truck Company, Chicago, Ill., has been incorporated to manufacture automobiles, motor trucks, etc. Capital, $50,000. Incorporators, Paul W. Herman, C. P. Williams, D. G. Ramsay.

The Rumely-Wachs Machinery Company, Chicago, Ill., has been incorporated with a capital of $30,000 by Lambert Kaspers, M. E. Rising, C. W. Greenfield, to manufacture and deal in iron and wood-working machinery.

The Breed Manufacturing Company, Detroit, Mich., has been incorporated with $100,000 capital to manufacture and sell motorcycles and supplies, etc. Incorporators, Thomas Wright, George W. Breed, John J. Ellis, etc.

The American Starter and Carbureter Manufacturing Company, Chicago, Ill., has been incorporated with $25,000 capital by James B. Dibelka, Frank Breska, Hayes McKinney. Will manufacture and deal in carbureters, auto-starting devices, etc.

Superior Manufacturing and Mill Company, Springfield, O., has been incorporated to manufacture and sell gas engines, gasolene engines and a general line of machinery. Capital, $50,000. Incorporators, George C. Lynch, John W. Burk, Jacob Koblegard, etc.

Knox Pressed and Welded Steel Company, Niles, O., has been organized with $125,000 capital to manufacture machinery and equipment for factories and furnaces. Incorporators, Maud E. Gillmer, Jane B. Griffith, John R. Lockman, Frank E. Rose and H. G. Hilsey.

Bids will be received at the office of the Director of Public Service, 104 City Hall, Cleveland, O., up to June 27, 1911, for furnishing a motor-driven engine lathe for the Fairmount pumping station. Specifications may be obtained of the superintendent of the water department.

The Cleveland Dental Manufacturing Company, Cleveland, O., making dentists' apparatus and supplies, has merged with Parkington & Slaight Company, of New York, and increased capital to $380,000. Another story and new equipment will be added to factory at once.

SOUTHERN STATES

Contract has been awarded for the erection of a $50,000 garage for the Automobile Club Garage Company, Lexington, Ky.

The Electric Vehicle Company, Louisville, Ky., has leased the building at Preston and

College streets, which will be fitted up as a garage.

The Western Maryland Railway Company will enlarge its repair shops at Hagerstown, Md. H. R. Pratt, Hilien Station, Baltimore, chief engineer.

WEST OF THE MISSISSIPPI

Harley Stanley, of Dale, Ia., will erect a blacksmith shop.

The University of Missouri, Columbia, Mo., will erect a new engineering shop.

The Martin Machinery Company, Joplin, Mo., will erect a machine and repair shop.

Robert Henry, Seattle, Wash., is having plans prepared for a commercial garage and repair plant.

The Owatonna Manufacturing Company, of Owatonna, Minn., will put up an auto-repair building.

The Automatic Air Pump Company, of Waterloo, Ia., will erect a plant. J. W. McMillan, secretary.

The California Iron Works, Riverside, Cal., has taken out a permit to build a large addition to its machine shop.

Edward Kevern, Kellogg, Idaho, will build a commercial garage and repair shop. Modern equipment will be installed.

Clyde Peebler, Portland, Ore., will build a commercial garage and repair shop. Modern equipment will be installed.

C. H. Leadbetter, Portland, Ore., will build a commercial garage and repair shop. Modern equipment will be installed.

The McDonnell Iron and Boiler Works, at East First street and Court avenue, Des Moines, Ia., was damaged by fire.

The Bean Spray Pump Company, San Jose, Cal., has taken out a permit to build an addition to its manufacturing plant.

The Western Hinge and Manufacturing Company, of Brookfield, Mo., is planning to move its plant to some other location.

Silas Sprouls, Los Angeles, Cal., has taken out a permit to build an addition to his automobile-repair shop on Grand avenue.

The Manual Arts High School, Los Angeles, Cal., will establish a new machine shop, forge and foundry. Dr. A E. Wilson, principal.

The power plant of the Portland (Ore.) Railway, Light and Power Company, at Vancouver, Wash., was destroyed by fire. Loss, $65,000.

The Lincoln (Cal.) Rectifier Company will build a plant for the manufacture of electrical specialties. Modern machnery will be installed.

The Kansas City, Mexico & Orient Railway Company is planning to remove its shops and roundhouse from Sweetwater, Tex., to San Angelo.

The E-M-F Northwest Company, Portland, Ore., will make improvements in its commercial garage and repair plant. New equipment will be installed.

F. W. Sawyer, of Wessington Springs, is putting up a building at Mitchell, S. D., to manufacture electric fixtures. Cost with machinery about $20,000.

The California Iron Works, San Diego, Cal., has asked a franchise for tide lands, and is planning for the erection of a plant for ship building, marine engine repairs, etc.

The Leeper Automobile Company, St. Louis, Mo., has been incorporated to manufacture automobiles and operate repair shop by Oscar W. Schmidt, Stewart B. Leeper, J. Leeper.

The Lamb Manufacturing and Cotton Cleaner Corporation, Dallas, Tex., has been chartered with $500,000 capital to build machinery for treating cotton. Plant will be erected.

The Witwer Motor Car Company, Kansas City, Mo., has been incorporated with $25,000 to manufacture motor cars. Incorporators, Frank Witwer, J. D. Welsh, Louis E. Loechler.

The Kansas City (Mo.) Engine Works has been incorporated with $100,000 capital to manufacture engines and do repair work. Incorporators, A. W. Calkins, J. E. Elliott, A. D. Elliott.

The Galveston-Houston Interurban Railway has started work on proposed machine shop at Houston, Tex. This concern is controlled by the Stone & Webster Engineering Company, of Boston.

The Eagle Manufacturing Company with headquarters in the Iowa building, Muskogee, Okla., has let contract for construction of plant in East Muskogee. Hay presses, etc., will be manufactured.

The San Diego (Cal.) Ignition Company, recently organized by Harry A. Brown, will establish a plant for repair work, etc., of automobiles and electric equipment. Modern machinery will be installed.

The Moran Shipbuilding Company, Seattle, Wash., will build a new steel floating drydock for ship repairs and a large foundry. About $1,000,000 will be expended upon these and other improvements in the plant.

The Gulf, Colorado & Santa Fe Railway has plans for improvements at the Galveston, Tex., yards to cost over $97,000. These include machine shop, blacksmith shop, power house, etc. F. Merritt, Galveston, chief engineer.

An industrial city is to be established near Dominguez Junction (close to Los Angeles, Cal.) by E. C. Sterling and J. H. Adams & Co. In the near future the following iron-working plants, now at Los Angeles, will be removed to the site: Baker Iron Works, Llewellyn Iron Works, California Industrial Company, Union Tool Company and the Lacy Manufacturing Company.

CANADA

The Hull Electric Company, of Hull, Que., will build big new shops.

The National Hardware Company will locate a big new plant at Orillia, Ont.

The Brantford Motor Truck Company will build a big new plant at Vancouver, B. C.

The Farmers, Steel and Wire Company will equip a big new plant at Regina, Sask.

The Farmer's Steel and Wire Company, Limited, Regina, Sask., will erect a six-story warehouse.

The Canadian Pacific Railway will build a big new tender and wheel shops at Weston, near Winnipeg.

The Alberta Foundry and Machine Company will build a large new factory at Medicine Hat, Alberta.

The Dominion Steel Corporation has commenced the erection of a large nail mill at its plant in Sydney, N. S.

J. C. Cherry Company, of Cedar Rapids, Ia., is planning to enlarge its cream-can factory at a cost of $250,000.

Canadian Pacific Railroad will erect large repair shops at North Bay, Ont., at once. Will spend half a million dollars.

The Grand Trunk Railway is to commence operations on the new roundhouse and machine shops, etc., at Prince Rupert at once.

McFarlane & Douglass, manufacturers of roofing and cornice material at Ottawa, Ont., have acquired land and will erect a large addition to their factory.

J. Robinson & Sons, of Niagara Falls, Ont., are calling for tenders up to August 1 for a quantity of electrically driven machinery, including lathes, drills, shapers, etc.

A new ship-building company of which Sir Henry Pellatt, of Toronto, is chairman, will equip a $10,000,000 plant at Halifax, N. S., will complete armor, electric light and refrigerating plants.

GENERAL MANUFACTURING

NEW ENGLAND

Deerfield, Mass., will build a new reservoir.

Lewiston, Me., will extend its water system.

Mars Hill, Me., will install a new water system.

North Adams, Mass., will improve its sewer system.

West Springfield, Mass., will improve its water system.

The Bridgeport (Conn.) Elastic Fabric Company will build a new mill.

The Hamilton Woolen Mills, Lowell, Mass., will erect a new spinning mill.

William L. Brown will install a boiler in the new theater, Danielson, Conn.

The Springfield (Mass.) Provision Company will build a new cold-storage plant.

The Old Town Canoe Company, Old Town, Me., will install a boiler and engine.

Cambridge, Mass., contemplates building a new municipal electric-lighting plant.

Southington, Conn., has voted bonds for $220,000 to improve its water system.

New Britain, Conn., will issue bonds for $40,000 to improve its sewer system.

The planing mill of W. Keller, West Newton, Mass., was badly damaged by fire.

Northampton, Mass., is considering the establishment of a municipal lighting plant.

Salem, Mass., will install a new high-pressure salt-water system. Pumps will be needed.

The factory of the Fairfield Lawn Swing Company, Brunswick, Me., was destroyed by fire.

The Winchester Laundry Company is excavating for laundry buildings at Winchester, Mass.

The Connors Brothers Company, Lowell, Mass., is in the market for woodworking mahinery.

The Boston Confestionery Company has placed a contract for a new factory in Cambridge.

The Chapple Publishing Company, Dorchester, Mass., will erect a new publishing building.

The Crown Manufacturing Company, Attleborough, Mass., is drawing plans for a cotton mill.

The Fiske Paper Company, Hinsdale, N. H., will install a boiler and engine at the Brightwood mill.

The Deering-Practor Company's box factory, at Biddeford, Me., was destroyed by fire. Loss, $40,000.

The department of public works, city of Everett, Mass., is in the market for valves and pipe fittings.

The Central New England Railway Company will install a boiler, engine and pumps, at Maybrooke, N. Y.

The Hygrade Knitting Company, 68 Market street, Hartford, Conn., factory totally destroyed by fire. Loss, $3000.

The Rhode Island Glass Company, recently incorporated at $100,000, will purchase land and erect a glass factory in Central Falls, R. I.

The Berkshire Street Railway Company is to erect a transformer station and also an addition to its power house in Pittsfield, Mass.

The Bay State Thread Company, Springfield, Mass., will build an addition to its factory at the corner of Main and Mill streets.

The Clogston Company, of New Haven, Conn., has been incorporated to manufacture paper boxes, etc. Capital, $25,000. Incorporators, J. O. Clogston, J. W. Clogston, O. E. Joos.

The Imperial Printing and Finishing Company, recently incorporated for $100,000, will equip the plant of the Old Whipple Dye Works Company, Bellefonte, R. I. Will engage in the business of dyeing and bleaching.

MIDDLE STATES

The Belfast (Me.) Shoe Company will build an addition to its factory.

The Bell Telephone Company will build a new exchange at Batavia, Ohio.

Fire destroyed the power plant of the Bayway (N. J.) Chemical Company.

The Wayne Knitting Mills Company, Fort Wayne, Ind., will erect an addition.

The Clark Dye Works, of Pittsfield, Mass., will build an addition to its factory.

Hawk & Co.'s hosiery mill, Reading, Penn., was destroyed by fire. Damage, $20,000.

The city of Detroit will install new boilers in the waterworks pumping station.

Fire gutted part of the Huff broom factory at Ballston Spa, N. Y. Loss, $3000.

Munson Brothers, of Utica, N. Y., will erect a large machine shop at Whitesboro, N. Y.

The plant of the Ashland (Wis.) Brew Company was burned. Loss about $15,000.

The Mohawk Silk Fabric Company, of Fultonville, N. Y., will erect a mill in Kingston.

Thieme Brothers Company, Fort Wayne, Ind., will erect an addition to its silk hosiery mill.

Fire destroyed the plant of the Salamanca (N. Y.) Veneer and Paint Company. Loss, $80,000.

The La Tosca Knitting Company, Utica, N. Y., will increase the size of its factory 15,000 feet.

D. D. Long will erect a candy factory at Oswego, N. Y. The building will be four stories high.

Camillus Cutlery Company, of Camillus, N. Y., will erect an additional building two stories high.

The Goodyear Tire and Rubber Company, Akron, Ohio, will build an addition to cost about $250,000.

The Jones & Laughlin Steel Company will build a coke plant at Aliquippa, Penn., at a cost of $3,000,000.

The Weeks Paper Mills, at Mottville, N. Y., are being remodeled, and the capacity is to be almost doubled.

The Agosote Millboard Company's, Trenton, N. J., plant was partly destroyed by fire. Loss, $50,000.

The Indianapolis (Ind.) Water Company is building several additions at its various plants about the city.

The Standard Wall Paper Company, Glen Falls, N. Y., is erecting an addition to its plant on Allen street.

The Continental Sugar Company, Cleveland, O., is planning on an $800,000 sugar beet mill at Toledo, O.

Schwarzenbach, Huber Company, West Hoboken, N. J., silk manufacturers, are going to build a new factory.

The West End Furniture Company, Rockford, Ill., which just completed an addition, has let contract for another.

The Golden Furniture Company, Jamestown, N. Y., will rebuild the portion of its plant recently destroyed by fire.

The Medina Gas and Fuel Company, Dayton, O., has increased its capital to $400,000 and will make improvements.

Battle Creek Paper Company, Battle Creek, Mich., is building an extension to its plant, which will nearly double its output.

The Schwarzschild & Sulzberger Packing Company will erect a meat-packing plant in Portland, Ore., at a cost of $500,000.

The Glens Falls (N. Y.) Portland Cement Company anticipate installing about 600 horsepower additional boiler capacity.

The National Envelope Company, Cincinnati, O., has been incorporated by F. L. Bardes, etc., to manufacture envelops, etc.

The Cement Unit Brick and Tile Company is erecting a plant at Schenectady, N. Y., for the manufacture of a patent building block.

The Hummel-Downing Board Mill and Paper Box Company, Milwaukee, Wis., has secured a permit for new $250,000 factory.

Contract has been awerded for a factory for the K. W. Ignition Company, at Chestnut avenue and East Thirtieth street, Cleveland, Ohio.

The Commercial Printing and Binding Company, Dayton, O., has increased capital to $100,000 and will make some improvements.

The city of Cleveland (O.) is planning on installing a battery of water pumps for high-pressure fire service. A. B. Lea, director.

The Stevens Manufacturing Company is erecting a plant at Rome, N. Y., for the manufacture of carbureters and other automobile supplies.

The Hicksville Handle Company, Hicksville, O., has been incorporated by William Purdy for $150,000, to manufacture line of handles.

The Mylocal Manufacturing Company, of Buffalo, N. Y., has incorporated and will manufacture dental drugs at 302 Main street, that city.

The machine shop and conveyor house of the Jamestown (N. Y.) Shale Paving Brick Company were destroyed by fire. Loss, $30,000. Will be rebuilt.

The Syracuse Rendering Company, Syracuse, N. Y., will erect a new building 72x180 feet, three stories high, to take care of increasing business.

A permit has been issued to A. Denny for a one-story power house on Witte street, south of Allegheny avenue, Philadelphia, Penn., to cost $22,000.

The Canton Pressed Brick Company, of Canton, O., has increased its capital stock from $52,500 to $200,000, and will make additions to the plant.

A. & H. C. Knowlton, chair manufacturers, of Buffalo, N. Y., have removed their plant from Louisiana street to larger quarters on Howard street, Buffalo.

Revere Rubber Company, Providence, R. I., capitalized at $4,000,000 has incorporated in Illinois for $40,000. It will establish a branch house in Chicago.

The Benjamin W. Snow Company has been formed in Syracuse, N. Y., and will manufacture automobile mufflers at the corner of Corland and Onondaga avenues, Syracuse.

A $50,000 fire in the drying shed and engine house of the Cary brick yards, at Newton Hook, near Coxsackie, N. Y., damaged and destroyed considerable machinery.

The Thomas Devlin Manufacturing Company, Burlington, N. J., is going to increase the capacity of its power plant. Will install new Corliss engine and generator.

The Bernheimer & Schwartz Pilsener Brewing Company, Amsterdam avenue and One Hundred and Twenty-eighth street, New York, will build an addition to its ice plant.

The Atlas Land Company has purchased the Weyman warehouse, a six-story structure, in Duquesne way, near Seventh street, Pittsburg, Penn., and will remodel it into a power plant.

It is reported that the Auburn Soap and Chemical Company, of Auburn, N. Y., is to move to Geneva, N. Y., locating in a plant vacated by the Hayes Track Appliance Company.

The Orange County Traction Company, Newburgh, N. Y., has asked the Public Service Commission for permission to make some improvements to its plant, with extensions to tracks.

The American Leather Products Company, Indianapolis, Ind., has been incorporated with $20,000 capital by E. E. Mitchel, R. M. Mason and E. L. Selvage, to do a manufacturing business.

The Ripley Ice Manufacturing Company, Ripley, Ohio, has been organized with $10,000 capital. Incorporators, Ernst Baumbach, F. E. Ross, J. E. Kirkpatrick, A. W. Francis and J. E. Newcomb.

The Wapakoneta & Kenton (O.) Traction Company has been formed to build an electric-railroad line. Capital, $50,000. Incorporators, S. Roberts, C. F. Knowlton, G. W. Welding and T. J. Cornell.

The Hinds Paper Box Works, Niagara Falls, N. Y., has been incorporated to manufacture paper boxes and paper-box machinery. Capital, $80,000. Incorporators, E. P. Hinds, A. L. Chapin, U. S. Thomas.

The Rock Run Mills, of Goshen, Ind., has been incorporated with a capital of $75,000 by W. L. L. Stoner, D. K. and W. L. Stephenson. The company will manufacture high-proof grade men's underwear.

C. H. Bidwell Thresher Company's plant, at Batavia, N. Y., has been sold to Warsaw-Wilkinson Company, of Warsaw, for $45,000. This concern manufactures feed cutters and other agricultural implements.

Harry Loeper, of the Waverly Ice and Coal Company, has purchased a site on the West Chester Railroad, between Thomas and Whitley avenues, Philadelphia, Penn., on which he proposes to build an ice plant.

J. M. Horton Company, of New York City, will rebuild at once its large milk-receiving and separating plant at Richville, St. Lawrence county, N. Y., which was burned recently, entailing a loss of $50,000.

The Muncie (Ind.) Heat, Light and Power Company, which supplies Muncie with natural gas, makes announcement that it has begun the work of installing an artificial gas plant to take the place of the natural-gas service.

The Munising Woodenware Company has been organized, taking over the business and patents of the Kalkasha Manufacturing Company and will do business on a much larger scale, manufacturing woodenware in Munising, Mich.

The Cotswold Comfortable Company, of Syracuse, N. Y., has taken over the G. T. Sherman Company, and will operate the plant at 1810 West Fayette street, manufacturing wool and cotton-filled comforters and mattress covers.

The Central Terminal Railroad Company has been organized to construct a railroad from Forest Park to Chicago. Principal office, Chicago. Capital, $2,000,000. Incorporators, Donald R. McLannan, Charles E. Vroman, Joseph W. Hiner, etc., all of Chicago.

The Hydro-Electric Power Company, of Mt. Carmel, Ill., is planning to generate and furnish electric power for southwestern Indiana, with Princeton, Ind., as a distributing point. The new power plant and dam will cost about $600,000. W. H. Zimmerman, of Mt. Carmel, is president.

Bids will be received by the board of managers of the Ohio penitentiary up to June 26, 1911, for equipment for a stone-crushing plant and quarry in accordance with specifications prepared by Marriott Allen & Hall, architects, Columbus, O. Part of the equipment consists of one friction hoist, one air compressor, five alternating-current motors, three transformers, etc.

SOUTHERN STATES

Fire destroyed the sawmill and engine house of the Parkersburg (W. Va.) Mill Company.

The city council, Lafayette, La., has decided to improve its electric-light plant, changing system from alternating to direct current. About $40,000 will be expended.

WEST OF THE MISSISSIPPI

The Porter-Stites Company, Vale, Ore., will build a new sawmill.

E. I. Culver, of Chisholm, Minn., is erecting a wood-working shop.

The Otis Elevator Company, of Houston, Tex., is erecting additions to its plant.

The installation of an electric-lighting system at Custer, S. D., is being planned.

The Star Brewery, at Dubuque, Ia., was damaged by fire to the extent of $10,000.

The plant of the Colesburg Pottery Company, at Manchester, Ia., will be enlarged.

The Iowa Canning Company, of Shellsburg, Ia., will enlarge and improve its plant.

The Alfalfa Meal Company, at Cadams, Neb., will rebuild its mill recently burned.

The Enameled Concrete Brick Company, Des Moines, Iowa, will erect a $100,000 plant.

The plant of the Sunset Telephone Company, Snohomish, Wash., was destroyed by fire.

A. Gossett, Baker, Ore., will build a plant for the manufacture of clay and pottery products.

F. C. Roberts & Co., Madera, Cal., will build a gas plant in this district in the near future.

The broom factory of Spikes Brothers, Dallas, Tex., was destroyed by fire. Loss, about $12,500.

J. W. Kelly, Bakersfield, Cal., plans for the installation of a complete telephone system in this section.

The Bakersfield (Cal.) Echo Publishing Company is having plans prepared for a new publishing plant.

The John Deere Plow Company, of St. Louis, Mo., will erect a four-story addition to buggy factory.

Harry C. Wilson, Lacrosse, Wash., is planning to erect a light and power plant, to serve this section.

The Soper-Wheeler Company, Oroville, Cal., is planning for the erection of a new planing and sawmill plant.

The Klamath Falls (Ore.) Light and Water Company will increase the capacity of its power plant.

J. W. Fletcher, Oroville, Cal., is planning for the erection of a furniture factory to cost about $150,000.

The Oregon Power Company, Eugene, Ore., is planning to install a new waterworks system at Albany, Ore.

Olson Brothers, Reedley, Cal., will erect a factory for the manufacture of a fruit cart invented by Clay Olson.

The Meacham (Ore.) Sawmill Company is planning for the erection of a new sawmill plant at Pendleton, Ore.

The city of Coalinga, Cal., has voted bonds for the installation of a sewer system. The city engineer is in charge.

The B. & B. Pump Supply Works, Los Angeles, Cal., has taken out a permit to build an addition to its plant.

The Kingman (Ariz.) Gas Company has acquired a site, and is planning for the erection of a new gas plant.

The city of Oakdale, Cal., has voted bonds for $82,000, for the installation of a waterworks and sewer system.

The plant of O. A. Trowbridge, Brandon, Ore., manufacturing broomhandles and specialties, was destroyed by fir.

The Inland Brewing and Malting Company, Spokane, Wash., is having plans prepared for a new bottling-works plant.

The Weiding & Independent Fisheries Company, Seattle, Wash., has had plans prepared for a new fish-packing plant.

A franchise has been granted to the Adel Milling Company to install an electric-light system at Dallas Center, Ia.

The East Tacoma (Wash.) Manufacturing Company is having plans prepared for a new dry-kiln addition to its plant.

J. W. Sefton, Jr., San Diego, Cal., has taken out a permit to build an addition to his pottery-manufacturing plant.

A chain of alfalfa mills will be located in the Yellowstone valley, Mont. Dr. W. X. Sudduth, Billings, Mont., interested.

The Nicholas Jerns' shingle mill, Silverbeach, Wash., was partially destroyed by fire. The dry-kiln plant was totally ruined.

A. L. Beatie, Oregon City, Ore., plans for the erection of a gas plant to serve this section. A franchise has been granted.

The Simons Brick Company, Los Angeles, Cal., has taken out a permit to build an addition to its brick-manufacturing plant.

The A. B. C. Packing Company, Anacortes, Wash., is planning for the erection of a new fish-canning plant on Seymour Inlet, B. C.

The sawmill of the Stearns Lumber Company, Hoquiam, Wash., was partially destroyed by fire. The plant will be rebuilt.

The San Pedro Lumber Company, San Pedro (Los Angeles), Cal., has taken out a permit to build an addition to its plant.

The Willapa Harbor Packing Company, South Bend, Wash., will erect a new canning plant. Modern machinery will be installed.

John Faulkner, Hutchinson, Kan., is planning for the erection of an ice plant at Portales, N. M. Modern equipment will be installed.

The Illinois-Pacific Glass Works, San Francisco, Cal., has taken out a permit to build a new plant, replacing that recently destroyed by fire.

The Pacific Telephone and Telegraph Company, Aberdeen, Wash., has had plans prepared for a new exchange building to cost $30,000.

J. C. Morton, Conconully, Wash., is planning to build a waterworks system and an electric-lighting plant. A franchise has been granted.

Senator E. M. Stephens, Monroe, Wash., is at the head of a project to build a sash and door factory and lumber mill in this district.

Lang & Co., Seattle, Wash., wholesale and manufacturing grocers, has leased a building at Portland, Ore., and will establish a canning plant.

Libby, McNeil & Libby, Chicago, Ill., fruit packers, are planning for the erection of a canning plant for small fruits in Eel River Valley, Cal.

The Grangeville (Idaho) Light and Power Company, is planning for the erection of a power plant in the Ten Mile section, in the near future.

Power-plant equipment will be required in the new six-story hotel planned by C. K. Henry, Portland, Ore. About $450,000 will be expended.

The city of Pasadena, Cal., contemplates additions and improvements in its municipal lighting plant to cost $35,000. C. W. Koiner, superintendent.

James Branham, Susanville, Cal., is planning for the installation of an electric light and power system in this section. A franchise has been asked.

The Santa Barbara (Cal.) Gas and Electric Company will issue bonds for $1,000,000, to be used for improvements and extensions in its plant and system.

The city of Tucson, Ariz., contemplates installing new centrifugal pumping equipment at its water property. W. H. Thompson, city engineer, is in charge.

The Dunsmuir (Cal.) Water, Power and Light Company is planning to make improvements and additions in its plant and system to cost $75,000.

The United Properties Company, San Francisco, Cal., is planning to install a power plant and an extensive irrigation system in the Santa Clara valley.

J. W. Small, Montesano, Wash., has acquired the lumber mill of George Ninemire. New equipment will be installed and extensive improvements made.

W. E. Alexander, Escondido, Cal., is planning for the erection of a precooling plant. About $25,000 will be expended. Modern machinery will be installed.

The grain and rolling mill of the Escondido (Cal.) Lumber, Hay and Grain Company was destroyed by fire. All machinery was ruined. The plant will be rebuilt.

In connection with its proposed power plant on the Feather river, the Great Western Power Company, San Francisco, Cal., will build a sawmill plant.

The Case Furnace Company, Tacoma, Wash., will build a new plant for the manufacture of furnaces and specialties at West Tacoma, in the near future.

The Midland Rural Telephone Company, Klamath Falls, Ore., recently organized, is planning to install a complete system between this city and Midland.

The Hartley Colony Company, Merced, Cal., is planning for the erection of a series of

pumping plants in this section. H. J. Rothschilds is head of this company.

Power-plant equipment will be required in the new hospital building to be erected by the county of Alameda (Oakland), Cal. About $500,000 will be expended.

The St. Louis Unit Construction Company will establish a plant at St. Louis, Mo., for manufacturing concrete-building material. William P. Carmichael, manager.

The box-making factory of the Redlands (Cal.) Orange Producers' Association, was destroyed by fire. Loss, $40,000. The precooling plant was also destroyed.

The Enamel Concrete Company, W. S. Purington, president, and the Des Moines Sand Company, S. Hutchins, president, will erect factories at Des Moines, Ia.

The Downey (Cal.) Milling Company (grain), is planning to increase the capacity of its plant. The Newmark Company, Los Angeles, Cal., controls this concern.

Armour & Co., Chicago, Ill,. has purchased property at North Powder, Ore., and is said to be contemplating the erection of a packing plant in the immediate future.

The California Brewing Company, San Francisco, Cal., has taken out a permit to build a brewing-house addition to its plant. Modern equipment will be installed.

The California Planing Mill and Lumber Company, Los Angeles, Cal., is planning for the erection of a new plant at Redondo Beach. About $100,000 will be expended.

Power-plant equipment will be required in the new 10-story office building to be erected by D. G. Scofield, vice-president of the Standard Oil Company of California, San Francisco.

The George H. Eilerman Lumber Company plans to build a new sawmill and planing mill at Escondido, Cal. George H. Eilerman, San Diego, Cal, is head of this company.

The Big Basin Lumber Company, Terminal, near Odessa, Ore., is planning for the erection of a new sawmill. The plant will be fully equipped and will be the largest in this section.

The Los Angeles (Cal.) Aqueduct Bureau is having plans prepared for one of the large power plants to be installed along the route of the aqueduct. E. F. Scattergood, chief engineer.

The Tulare Power Company, Porterville, Cal. (C. H. Holley), will build a new power plant on the Upper Tule river. Auxiliary steam plants will be installed near Tulare and Strathmore.

The Santa Fe Land and Improvement Company, a subsidiary of the Santa Fe Railroad, has purchased extensive timber property at Ukiah, Cal., and is planning to install a sawmill plant.

The Elcasco Dairy Company, Redlands, Cal., has been incorporated by C. A. Juffer and J. H. Fisher, with a capital of $100,000. The company plans for the erection of a modern creamery plant.

Power-plant equipment will be required in the new five-story city hall to be erected at Spokane, Wash. Estimated cost, $650,000. Plans are being prepared by Julius Zittel, architect, Spokane.

Power-plant and refrigerating equipment will be installed in the new hotel building to be erected by W. J. Gelerman, Altadena, Cal. Estimated cost, $150,000. Albert C. Martin, architect, Los Angeles, Cal.

J. A. Huston, Carthage, Mo., has purchased the Loving (N. M.) cotton-ginning plant. The plant will be remodeled and its capacity doubled. New equipment, including new engine will be installed.

The Auto Gas Engine Starter Company, Olympia, Wash., recently incorporated, is planning to build a manufacturing plant at San Francisco, Cal. Allen Weir, Olympia, is interested in this company.

The Great Falls (Mont.) Power Company plans for the erection of a series of substations between here and Lewiston. The company is also contemplating other work in connection with its power enterprises.

The Western States Gas and Electric Company, Eureka, Cal., has acquired the plants of the Ferndale (Cal.) Lighting Company. The company will make extensive improvements and install new equipment.

In connection with its new brewing plant, now under construction, the Wood Brewing Company, Los Angeles, Cal., will install a large bottling works addition. About $25,000 will be expended for modern equipment.

The El Centro (Cal.) Cold Storage and Bottling Works has been organized by W. C. and L. R. Thomas. The company will build a large bottling works and cold-storage plant on Third street. An ice-cream factory will also be established.

Power-plant, vacuum-cleaning and compressed-air plant equipment will be installed in the new 10-story doctors' office building to be erected by Louis J. Wilde, San Diego, Cal. Estimated cost, $210,000. W. J. Saunders, architect, Los Angeles, Cal.

CANADA

Halifax, N. S., will equip a new sewer system.

Middleton, N. S., will equip a new electric-lighting plant.

J. A. Frieland, of Regina, Sask., will erect a cement plant.

Lacombe, Alberta, will install a new waterworks pumping plant.

Battleford, Sask., will install a new waterworks pumping system.

The Gilmour Soap Company will equip a big new plant at Winnipeg.

Stellarton, N. S., will install a complete new waterworks pumping plant.

Hamilton, Ont., will shortly spend $500,000 on a new power and light plant.

Fire destroyed the entire plant of the Quebec steam laundry, Quebec City.

Canada Refining and Smelting Company, of Orillia, Ont., is doubling the plant.

Canora, Sask., will spend $100,000 for new waterworks and electric-lighting machinery.

Fire destroyed the Hurndall Furniture Company, of Orangeville, Ont. Loss, $50,000.

John Stirrett & Sons will equip a new $85,000 door factory at Midway, near Port Arthur, Ont.

Much new machinery will be purchased for the La Colle Falls power station at Prince Albert, Sask.

Fire caused $25,000 damage to the plant of the London Cold Storage Company, at London, Ontario.

The Otonabee Power Company, of Peterborough, Ont., will buy $200,000 worth of new machinery.

Moncton, N. B., will buy $16,000 worth of additional machinery for its waterworks pumping station.

The Medicine Hat Printing and Publishing Company will spend $150,000 equipping a big addition to its plant.

The Otanabee Power Company, Peterboro, Ont., will spend $200,000 on increasing its equipment to provide an output of 4000 horsepower.

W. L. Coulson, general manager, Canadian Collieries Company, at Comox, B. C., will purchase a large quantity of hydro-electric equipment, including two direct-connected units, each capable of developing 3750 kva. at switchboard, equipment for big new power house and for big pipe line.

MINING

The Indiana mines, Pioneer, Nev., contemplates the erection of a milling plant.

The Gate City Oil Company, Bakersfield, Cal., is planning to install new drilling equipment.

The Nugget Gold Mines Company, Nelson, B. C. will soon be in the market for a 20-stamp mill.

The United Verde Copper Company, Jerome, Ariz., contemplates the erection of a new smelting plant.

The Last Chance mine, near Elk City, Idaho, plans for the erection of a stamp mill in the near future.

The Kittie Burton Gold Mining Company, Ulysses, Idaho, is planning to increase the capacity of its mill.

The Lincoln Consolidated Mining Company, near Sutter creek, Cal., contemplates the erection of a stamp mill.

The Yellow Aster Mining Company, Randsburg, Cal., contemplates increasing the capacity of its stamp mill.

The Humboldt mine, Mormon Basin, near Durkee, Ore., is planning to increase the capacity of its stamp mill.

The Calumet & Arizona Mining Company, Douglas, Ariz., will build a new smelting plant. Estimated cost, $1,500,000.

The Double Header Mining Company, Nespelem, near Wenatchee, Wash., contemplates the erection of a stamp mill.

The Tuscarora-Nevada Mines Company, near Tuscarora, Nev., is contemplating the erection of a milling plant in the near future.

The Dixie Meadows Mines Company, near Prairie City, Ore., contemplates the erection of a new stamp mill and smelting plant.

The Beaver Dam Mining and Milling Company, Beaver Dam, near Valdez, Alaska, is planning for the erection of a new stamp mill.

The Big Blue Mining Company, near Wickenberg, Ariz., is planning for the erection of a concentrating plant. Col. E. F. Browne is head of this property.

The Twin County Mines, Smelting and Refining Company, Idaho Springs, Idaho, a subsidiary of the Reid Company, Limited, is planning for the erection of an electric-smelting plant.

BUSINESS ITEMS

The shop of the Jaeger & Sword Manufacturing Company has been moved to 188 Main street, New London, Conn.

The offices of Thomas W. Pangborn Company have been consolidated with the Jersey City plant, and all communications should be addressed to Hudson and Morris streets, Jersey City, N. J.

LaFayette Electric and Manufacturing Company has purchased the plant and equipment of the Sterling Electric Works, of LaFayette, Ind., and will continue the manufacture and sale of Sterling telephones and electrical supplies.

TRADE CATALOGS

Schuchardt & Schutte, 90 West street, New York. Folder. Hand tachometers. Illustrated.

Landis Tool Company, Waynesboro, Penn. Pamphlet. Cam grinding attachments. Illustrated, 8 pages, 6x9 inches.

Triumph Electric Company, Cincinnati, O. Bulletin No. 471. Polyphase induction motors. Illustrated, 12 pages, 7x9½ inches.

Maris Brothers, Fifty-sixth street and Gray's avenue, Philadelphia, Penn. Pamphlet. I-beam trolleys. Illustrated, 3½x6 inches.

Fort Wayne Electric Works, Fort Wayne, Ind. Bulletin No. 1127. Direct-current grinders and buffers. Illustrated, 12 pages, 8x10½ inches.

Mesta Machine Company, Pittsburg, Penn. Catalog. Steam-hydraulic forging and bending presses. Illustrated, 24 pages, 6x9 inches.

The United States Electrical Tool Company, Cincinnati, O. Catalog H. Portable electrical tools. Drills, grinders. Illustrated, 64 pages, 6x9 inches.

Hammacher, Schlemmer & Co., Fourth avenue and Thirteenth street, New York. Catalog No. 427. Colt's quick-acting clamps. Illustrated. 4x7½ inches.

The Richardson Engineering and Manufacturing Company, Hartford, Conn. Catalog House electric-lighting outfits. Illustrated, 16 pages, 4x9 inches.

United Engineering and Foundry Company, Pittsburg, Penn. Catalog. High-speed forging presses, steam-hydraulic intensifier type. Illustrated, 48 pages, 8x10½ inches.

Landis Tool Company, Waynesboro, Penn. Pamphlet, "A Trip Through the Plant of the Landis Tool Company," showing manufacture of grinding machines. Illustrated, 32 pages, 6x9 inches.

Pawling & Harnischfeger Company, Milwaukee, Wis. Pamphlet, "The Plant and Its Products." Hoists, switches, turntables, drilling and boring machines, cranes, etc. Illustrated, 48 pages, 6x9 inches.

The Hess-Bright Manufacturing Company, Twenty-first street and Fairmount avenue, Philadelphia, Penn. Pamphlet. "Ball Bearings in Wood-working Machinery." Illustrated, 32 pages, 6x9 inches. Pamphlet, "Ball Bearings in Flour and Feed Milling Machinery." Illustrated, 20 pages, 6x9 inches.

FORTHCOMING MEETINGS

National Gas and Gasolene Engine Trades Association, summer meeting, Detroit, Mich., Hotel Ponchartrain, June 20-23, 1911.

Society for the Promotion of Engineering Education, annual convention, June 27-29, Pittsburg, Penn. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

American Society for Testing Materials, annual meeting, June 27-30, Atlantic City, N. J. Edgar Warburg, secretary, University of Pennsylvania, Philadelphia, Penn.

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. M. W. Rice, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Automatic and light machinery, tools, dies, jigs and fixtures designed. B. Nash, 257 Martense St., Brooklyn.

Wanted—What have you to offer for machinery we could build to increase our business. Box AX, AMERICAN MACHINIST.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

We must have more capital to meet growing demand for small, high class machine, without competition, write for particulars. Box 962, AMERICAN MACHINIST.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Patents—An able mechanical engineer will see and protect technical points better; valuable suggestions and assistance in developing inventions. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

Wanted—A person, firm or corporation with sufficient capital and organization to handle a patented device (no existing competition) in metal (no manufacturing plant required), sale of which may reach one to ten million dollars per annum. Box 982, AMER. MACH.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools, invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraph Company, Baltimore, Md.

Business Opportunity—A New England corporation, first-class reputation and credit, well established in a most favorable business location, taking up a newly developed line of machine manufacturing business, desires an active partner with capital to take charge of machine shop; good business and profits assured; a young man with executive and mechanical ability, technical education and some experience in machine shop practice is preferred. Address for personal interview, giving name and address; no agents or promoters to Box 955, AMERICAN MACHINIST.

We will shortly be ready to place contracts for a large number of machines, weighing about 1000 pounds and requiring a good grade of work, about like machine tools; we desire to correspond with parties having modern equipment, who are in position to handle this work to advantage and are able to turn out high grade work at a fair price; we prefer to place the business with parties who are prepared to take care of our requirements for a considerable time; the product will stand a fair shop profit and if we can get the right kind of work and get it continuously, we are willing to pay a fair price; if interested, please state size of plant, number of men which can be employed on our work, and foundry facilities. Box 973, AMER. MACH.

A large and well known firm in central New England, which has been engaged in the manufacture of special machinery for upwards of forty years, is desirous of taking on some outside lines, its own legitimate line of manufacture being suffering from a depression in business, and in order to keep as many of its employees busy, and its organization as intact as possible during the dull period, we wish to make connections for taking on outside lines of machine work; our plant is a very complete and modern one; our machine tool equipment represents an investment of about $125,000; we have a full line of gear cutters, automatic screw machines, and Jones & Lamson turret lathes, etc.; our capital is ample, and we guarantee to handle in a satisfactory manner any work that may be intrusted to us. Write us your requirements. Address Box 72, Worcester, Mass.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—Experienced hydraulic engineer to take charge of sales of water wheel installations; state experience. Apply to William Hamilton Company, Ltd., Peterborough, Ont.

Wanted—A first class tool and die maker; applicant to possess some executive, with the view of eventually taking charge of department. Reply, giving age, experience and reference to Box 989, AMERICAN MACHINIST.

Wanted—Mechanical partner with eight to ten thousand dollars capital in growing business in Canada; no encumbrance; must possess thorough knowledge of jig designing; to produce small interchangeable parts requiring rapid and accurate assembling; also gear cutting and building of marine motors. Address P. O. Box No. 682, Montreal, Canada.

CONNECTICUT

Wanted—First class toolmaker. Address B. L. Co., Norwich, Conn.

ILLINOIS

Wanted—Designing engineer on light machinery and tools for steady position with well established manufacturing company that is growing rapidly, located in Chicago; give age, experience and salary expected; communications will be kept in strict confidence and returned if desired. Box 977, AMER. MACH.

Wanted—First-class machinist and toolmaker to take charge of tool room and machine repairs in machine shop employing about one hundred and fifty men; no jig designing required, but must be energetic, systematic and capable of handling eight to ten men efficiently. Address "Gas Engines," AMERICAN MACHINIST.

INDIANA

Wanted—Foreman for tool room; experienced man on punch, die and forming tools. Apply by letter, giving detail of account of past experience. Box 926, AMER. MACHINIST.

MASSACHUSETTS

Wanted—Man to take charge of shipping and cleaning room in iron foundry; must be experienced and have good executive ability; good position for the right man. Box 983, AMERICAN MACHINIST.

High speed steel demonstrator and salesman wanted by a well known house for a brand of high speed and carbon steels, long established and extensively used; competent man with an acquaintance in Illinois, Wisconsin, Minnesota, Michigan and Iowa preferred; give full particulars, including age and salary expected. "J. B.," AMER. MACH.

MICHIGAN

Wanted—Draftsmen, first-class layout men on automobile work; state age, experience and salary desired. Write Box 979, AM. MACH.

NEW JERSEY

Wanted—Assistant purchasing man; must be familiar with machine shop and the manufacture of gas engines. Box 985, AM. MA.

Openings for first-class all-around machinists; men used to automobile manufacturing; steady employment with good wages for efficient men. Box 924, AMERICAN MACHINIST.

Foreman for department employing about thirty-five men on Monitor screw machine work; must be familiar with hand and automatic machine; an uptodate, energetic man required. Box 965, AMER. MACHINIST.

Draftsmen—Competent men with broad experience in mill building construction, power plant design and general engineering wanted at once by large industrial plant near New York City; full particulars as to experience, age, salary and references wanted. Box 991, AMERICAN MACHINIST.

Wanted—A first class metal pattern maker, experienced in making patterns for ornamental castings; must also be familiar with plate and vibrator frame work for Tabor machine; applicants must give full advice as to nature and extent of experience and wages expected. Box 986, AMERICAN MACHINIST.

Foreman-manager, middle aged, practical man with some theoretical knowledge who can bring results by applying most modern methods; factory 15 miles from New York City, making small agricultural implements; state age, experience and wages expected. "C B A." Box 978, AMERICAN MACHINIST.

Wanted—Department foreman, a man to take full charge of 50 to 75 men; must be thoroughly familiar with modern methods and have ability to handle men to the best advantage and produce results; good position for the right man; reference required. Address, stating full particulars, Box 2, AM. M.

Assistant foreman wanted for machine shop building gasolene engines from 4 to 500 horsepower; must be familiar with uptodate methods and machines; must be energetic and capable of placing work so as to get the best possible results; apply by letter only, giving experience, reference and salary expected. Standard Motor Construction Co., 172 Whiton St., Jersey City, N. J.

NEW YORK

Designer and draftsman for general machinery; location within 100 miles of New York City. Box 984, AMERICAN MACHINIST.

Experience in designing tools for building dental engine hand pieces or similar appliances, and superintending their manufacture, will count heavily in your application for desirable position with "M," AMER. MACH.

Wanted—Machinists wanted, lathe hands, screw machine hands, etc.; steady position, desirable surroundings, good wages, no labor trouble. Apply by letter, giving account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Wanted—First class tool and die makers, drop-forge die sinkers, Fox lathe hands; steady position, good wages, no labor trouble; apply by letter, giving detailed account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

First class mechanic wanted for experimental work on small machinery; big opportunity for right man; experienced, accurate economic methods, capable of taking charge, assembling new devices; knowledge of electricity desirable. Apply Room 49, 40 Wall St., New York City.

OHIO

High grade machine tool salesman or selling engineer, preferably a man about 35, having had shop and some commercial experience, and technical education, capable of recommending equipment; location Middle West. Box 976, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Wanted—Draftsman on machine tools and jig work; must be able to design jigs and have had practical shop experience; state salary wanted. Box 980, AMERICAN MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—50 tool makers; experienced men on jigs, fixtures, punches and dies and other special tools used in the manufacture of high grade machine parts on an interchangeable basis; apply by letter, stating age, experience and salary required, as well as the date when you would be able to start if application was accepted. The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Mechanical superintendent, broad experience in factory efficiency, executive and a organizer, engaged, would correspond, location immaterial. Box 902, AMER. MACH.

ILLINOIS

Mechanical engineer, 32, thoroughly acquainted with modern shop methods, first-class systematizer of drafting offices, and designer of automatic machinery, with long and successful practical and technical experience in conducting experimental work, is open for position in accordance with his qualifications. Address Box 30, AMERICAN MACHINIST, 122 South Michigan Boulevard, Chicago, Ill.

INDIANA

Position as department superintendent, assistant superintendent or master mechanic, by a competent mechanic and executive; now employed as foreman in a modern equipped machine shop; experienced in jobbing and repair work as well as interchangeable manufacturing; good designer of jigs and fixtures; technical graduate; age 30. Box 994, AMERICAN MACHINIST.

MAINE

Manager or superintendent of machine shop, forge or foundry; first class references. Box 996, AMERICAN MACHINIST.

MASSACHUSETTS

Superintendent or assistant superintendent; 20 years' practical experience on general machine and tool work; uptodate in organization and cost systems; best of references. Box 954, AMERICAN MACHINIST.

Mechanical engineer, draftsman, designer, college graduate, with nine years' practical shop and office experience on general engineering, desires progressive position; would consider sales department. Box 988, AM. M.

American, 41 years of age, 23 years' experience as manager, superintendent, systematizer, chief designer on jigs, drop forge, die sinking, die making of all kinds and complicated machinery, hustler, 16 years with one company, but desires change; best of references. Box 990, AMERICAN MACHINIST.

MEXICO

Two experienced men wish position installing and equipping mining or manufacturing plants complete, including jigs and fixtures; Mexico or South America preferred; three years' foreign experience; recommendations. Box 987, AMERICAN MACHINIST.

MINNESOTA

Mechanical draftsman, one year technical graduate, experienced designer gas traction engines, also designing and building motor boats and canoes, wants boat or engine work; $100. Box 998, AMERICAN MACHINIST.

NEW JERSEY

Foreman or assistant foreman, age 26, 10 years' experience, three as foreman on paper handling and general machinery. Box 995, AMERICAN MACHINIST.

NEW YORK

Young man, 24, desires position as detailer or tracer; I. C. S. student; references. Box 1, AMERICAN MACHINIST.

Master mechanic and chief planner desires change; capable man, large job; splendid record. W. J. H., AMER. MACH.

Designer of crude-oil high-compression reversible engines, open for responsible position of design or construction. Box 999, AM. MA.

Mechanical engineer, technical graduate, eight years' experience, desires a position in or near New York City. Box 949, AM. MACH.

Mechanical superintendent, experienced automatic machine designing and building, tool work, punches and dies and sheet metal drawing; screw machines. Box 997, AM. MACH.

Expert mechanic, having 18 years' experience as salesman and trouble man, will be open for position July 1; highest class references as to ability and integrity. Box 961, AMERICAN MACHINIST.

Manufacturing engineer; thoroughly grounded in different phases of light and medium manufacturing on large scale; successful record, with present employers ten years. Box 900, AMERICAN MACHINIST.

First class wood patternmaker (28), at present employed, desires change; experienced on gasolene engine and experimental work; best of references; New York or vicinity preferred. Box 993, AMER. MACH.

I am technically educated, 38 years old, have excellent record for inventing, developing and organizing the manufacture of duplicate machinery and apparatus; ten years in present position; satisfactory references; salary $3600. Box 992, AMERICAN MACHINIST.

Wanted—Position with responsible company, having special machinery to design and develop, by thorough mechanic who has successfully handled this class of work for number of years and can give satisfactory references; New York or New Jersey preferred. Box 970, AMERICAN MACHINIST.

OHIO

Superintendent, at present employed, desires change; 20 years' factory experience; first class mechanic, experienced in all branches, accustomed to very accurate work as well as medium grade; references. Box 969, AMERICAN MACHINIST.

Wanted—Position as manager or general superintendent; thoroughly practical and experienced in the management of manufacturing plants, consisting of main office, machine shop, foundry, blacksmith shop, boiler shop, wood shop and kindred departments; will take charge on salary or commission or both, and with highest degree of productive efficiency and lowest cost of production, guarantee freedom from labor troubles of every description. Box 966, AMERICAN MACHINIST.

A superintendent with 20 years' experience and a factory manager with 15 years' experience, both 35 years old and connected with same company and more than making good, desire a wider field and will make a profitable change; will guarantee to organize and systematize any manufacturing establishment, obtain maximum output at minimum cost; correspondence is invited or a visit to the plant where they are at present employed. Box 925, AMERICAN MACHINIST.

PENNSYLVANIA

Superintendent, 15 years' experience, engines, boilers, power transmission machinery, etc., desires a change. Box 935, AMER. MACH.

RHODE ISLAND

Draftsman, 30, machine and small tools, jigs; six years Alfred Herbert, also shop experience nine; moderate wage. Box 981, AMERICAN MACHINIST.

FOR SALE

Patent on combined nail puller and band cutter for sale. Box 952, AMER. MACHINIST.

Acme nut tapper, 4 spindle, new, takes ⅝ to 1 inch hexagon or square; cost $350, price $200. J. L. Lucas & Son, Bridgeport, Conn.

For Sale—One second hand Niles 26-inch by 21-foot engine lathe, complete with countershaft and attachments. A quick buyer gets a bargain. The Platt Iron Works Company, Dayton, Ohio.

Factory for sale in Dayton, Ohio; 95,000 square feet floor space; all modern improvements; direct railroad connection. Nicholson & Company, Sole Agents, 150 Broadway, New York, factory brokers.

For Sale—One ¾-inch new model Cleveland automatic screw machine with three spindle speed attachment, tilting magazine and complete set of tools; new machine in perfect condition; has been used not more than 700 hours; not adapted to our work. Box 956, AMERICAN MACHINIST.

Talks With Our Readers

By The Sales Manager

You've been reading about the champagne riots in France.

They are nothing more nor less than a state of almost civil war over a trade name—the use of the word "champagne."

The situation is of national importance, because of the European habit of using geographical names for trademarks.

The French government was obliged not long ago to "delimit" the area of "Bordeaux" champagne, because it had overlapped the geographical boundaries. Growers in Aube were naming their product "Bordeaux," claiming it to have become generic.

The big growers in France are now pushed off the champagne platform with a herd of others because they did not make their products known individually.

In a forceful way is the power of a trade-mark being vividly demonstrated.

Conservation and popularization of trade-mark value is the foundation rock of manufacturing success.

Advertising is the modern way to fix identity and affirm quality.

* * *

All of us are not only buyers but we make something to sell and will be interested to know the limitations of the trade-mark law in the United States.

Chapman in his book on the subject states:

A trade-mark must not be identical with a registered or known trade-mark.

Must not be obviously descriptive of the character or quality of the product.

A mere proper name.

A mere geographical name.

Mere name of building or business location.

Name or picture of a living person without consent.

Mere designation of material, such as tin, paper, white leather, etc.

Designation of form, size, color or designation of package.

Merely the color of an article or its label.

It must not be composed of the flag, coat of arms or other insignia of the United States, any state or municipality, or resemble their insignia.

A trade-mark must not be obscene or otherwise immoral.

It must not be a misrepresentation of origin, make, quality, contents or ingredients of the article with which it is associated, nor be exploited by advertising which contains misrepresentation.

All of these limitations are an encouragement to good advertising and a protection to buyers.

* * *

Only reliable products can be continuously advertised.